ALLEN'S
COMMERCIAL ORGANIC ANALYSIS

VOLUME VI

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ALLEN'S COMMERCIAL
ORGANIC ANALYSIS

A TREATISE ON

THE PROPERTIES, MODES OF ANALYSIS, AND PROXIMATE ANALYTICAL EXAMINATION OF THE VARIOUS ORGANIC CHEMICALS AND PRODUCTS EMPLOYED IN THE ARTS, MANUFACTURES, MEDICINE, Etc.

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WITH CONCISE METHODS FOR

THE DETECTION AND ESTIMATION OF THEIR IMPURITIES, ADULTERATIONS, AND PRODUCTS OF DECOMPOSITION

VOLUME VI

Colorimetry, Dyes and Colouring Matters, The Synthetic Dyestuffs, and The Analysis of Colouring Matters

BY THE EDITORS AND THE FOLLOWING CONTRIBUTORS

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FIFTH EDITION, REVISED AND IN PART REWRITTEN

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PREFACE

This volume has been not only rewritten, but also entirely changed in arrangement and composition from the form of the sections in the preceding edition on "Dyestuffs" which appeared largely in Volume V of the Fourth Edition. The greater part of this volume is made up of two long articles by recognised experts, namely the article on "Dyes and Colouring Matters" by Dr. Hans Edward Fierz-David of Zurich, Switzerland, and "Synthetic Dyestuffs" by Dr. A. W. Joyce of New York City, N. Y. These articles, from two different standpoints, practically cover the field of identification of the dyestuffs by direct testing as the chemical entity, and by testing the substances obtained by splitting up the dye colour.

In addition to these, there are the articles on Colorimetry and Analysis of Dyestuffs, freshly written for this volume.

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COLORIMETRY

BY W. A. GALLUP, S. B., DR. SC. TECHN.,

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Introduction.—Colorimetry means colour measurement. As the term is commonly employed, it refers to the measurement of the depth of colour of solutions and to certain methods of quantitative analysis which are based upon such measurements. The simplest instrument for measuring the depth of colour of solutions is the Colorimeter. Another instrument which may be used for the measurement of the depth of colour upon dyed fabrics, as well as in solutions, is the Tintometer. The colorimeter and the tintometer measure depth of colour by measuring the absorption which the solution or the dyed cloth exercises upon white light. The Spectrophotometer measures the intensity of absorption of solutions for light of definite wave-lengths. All these methods, and some others which are not discussed in this article, may be considered as coming under the head of colorimetry in its broader sense.

It is proposed in this article to give an account of the more important colorimetric methods with special reference to their application to the investigation of dyestuffs. But in order to make clearer the subsequent treatment of this subject, we shall first discuss briefly the nature of colour and its characteristics of depth and hue.

Colour, Hue and Depth of Tint.—The colour of any body which does not itself emit light-waves, such as a dyed piece of cloth, a copper sulphate crystal, or an aqueous solution of potassium dichromate, is produced by the *selective absorption*[1] which the substance exercises upon the white light which illuminates it. Such a substance will absorb light of certain wave-lengths with greater or less intensity and reflect or transmit light of other wave-lengths without absorbing

[1] White, grey, and black objects and colourless, transparent solutions or liquids do not absorb *selectively* but exert the same action upon light of all wave-lengths. White objects reflect nearly all the light which falls upon them, grey objects reflect part of the light which illuminates them and absorb part, and black objects absorb almost all the light. Colourless, transparent liquids transmit light with very little absorption.

it to an appreciable extent. When an object absorbs or takes from white light of a certain colour, *i. e.* light-waves of a certain wave-length, the unabsorbed light-waves combine to produce light of another colour and the object itself appears this colour. Since light of this colour and light of the colour which has been absorbed combine to give white light, the two colours are called *complementary colours.* The colour, therefore, of any body which possesses the property of selective absorption is the complementary colour to the colour of the light which the substance absorbs, and its nature—whether it be blue, red, green, etc.,—is determined by the region of the spectrum in which absorption takes place. This qualitative characteristic of colour is known as *hue* or *colour-tone.*[1]

A colour of any given hue may, however, vary quantitatively with the intensity of the absorption which produces it. Consider, as a simple example, a piece of white cloth dyed with Indigo; the effect differs according to whether a 1, 2, or 3% dyeing is made, though the hue remains unchanged.[2] The difference in appearance of the colour is due to variation in the intensity with which the light is absorbed, the 3% dyeing absorbing a greater proportion of the light which falls upon it than the 1% or the 2% dyeing. This quantitative characteristic of colour which depends upon intensity of light-absorption is called *strength, intensity, depth,* or *depth of tint.*[3] It is this which colorimetric methods measure.

Uses of Colorimetry in the Investigation of Dyestuffs.[4]—Colorimetric methods have two principal uses in connection with the investigation of dyestuffs: they are employed in making analyses, such as the determination of the percentage pure colouring matter in a sample of dyestuff or (with the tintometer) upon a dyed fabric, and in carrying out such non-analytical determinations as the measurement (with the tintometer) of the depth of colour upon a dyed fabric or the estimation of the "colour-strength" or "value" of a sample of dyestuff in terms of a "standard" dye.

For practical purposes, determining the "value" of a colouring matter means ascertaining how much of it is required to produce the

[1] German: Farbton, Nuance.

[2] This is not strictly true either for dyed fabrics or for solutions. See G. u. H. Krüss, Kolorimetrie und Quantitative Spektralanalyse, 2 Aufl. Voss, 1909, S. 4, for a discussion of the change in hue of a solution with change in its concentration.

[3] German: Farbstärke, Farbintensität.

[4] The investigation of dyes is not the only, or even the chief, use to which colorimetric methods are put. For other uses see G. u. H. Krüss, Kolorimetrie u. Quantitative Spektral, analyse, and Houben-Weyl, Die Methoden der Organischen Chemie, 2 Aufl. Thieme, 1921-Bd 1, S. 252.

same depth of colour upon the fibre which is produced upon the same weight and kind of material under the same conditions by the use of a definite quantity of the standard. The two dyestuffs thus compared may indeed be different chemical compounds; more frequently they are of the same chemical constitution and differ only in their degree of purity. They must not differ appreciably in hue. The common method of determining the value of a sample of dyestuff is to make a series of Comparative Dye-trials.[1] Samples of cloth or yarn are dyed under identical conditions with slightly varying percentages (0.8, 0.9, 1.0, 1.1% etc.) of the colouring matter under investigation and of the standard and the resulting dyeings are compared with respect to their depth. If it be found, for instance, that a 1.1% dyeing with the dye under investigation produces the same effect as a 1.0% dyeing with the standard, then the dye in question is weaker than the standard. To obtain any particular depth of colour with this dyestuff, it would be necessary to use an amount 10% in excess of the quantity of the standard required to give that depth under the same conditions.

A similar comparison of the tinctorial strength of two samples of colouring-matter may frequently be made more rapidly and easily by colorimetric methods. In this connection it should be remembered, however, that the depth of colour which a dyestuff produces *upon the fibre* depends not only upon the intensity with which it absorbs light, but also upon its affinity for the fibre. This may differ materially between two dyes which produce nearly the same hue but are different chemical compounds, so that a colorimetric comparison alone would in such a case be of little value. Moreover, commercial dyestuffs frequently contain small amounts of coloured impurities which, although insufficient to affect the colour of the dyed fabric, will, nevertheless, impair the accuracy of colorimetric measurements. Colorimetry cannot, therefore, in all cases supplant the more arduous method of making comparative dye-trials, though it may be of value in checking the results so obtained. It can, however, be used to advantage when the dyes to be compared manifest no marked difference in their affinity for the fibre, contain no coloured impurities, are of the same or nearly the same hue, and when their solutions behave in accordance with Beer's law of absorption.

[1] Knecht, Rawson and Loewenthal, A Manual of Dyeing, 5th ed. Vol. 2, p. 810. Georgievics, Technologie der Gespinstfasern, 4 Aufl., Deuticke, 1924 S. 176, and other standard text books and dyers' manuals.

In connection with the use of colorimetric methods for the quantitative determination of colouring matters the affinity of the latter for the fibre need not be considered. Samples of dyestuff in which the pure colouring matter is to be determined by means of the colorimeter or the tintometer must contain no coloured impurities. The spectrophotometer, however, may in certain cases be employed to determine a colouring matter in the presence of coloured impurities, or even in a mixture of two colouring matters. All solutions to be subjected to colorimetric investigation for whatever purpose must behave in accordance with Beer's law.

Beer's Law of Absorption.—When a beam of light enters a column of the solution of some coloured substance, a fraction of it is absorbed, and the light emerges reduced in intensity, as well as altered in colour. The intensity with which absorption takes place is reflected in the depth of tint which the column of solution appears. For most coloured substances in solution the following relation, known as Beer's law, between the intensity of absorption, the height of the column, and the concentration of the solution holds good: the intensity of absorption varies directly with the concentration of the solution, when the height of the column remains unchanged, or directly with the height of the column, when the concentration of the solution remains unchanged. When the concentration of the solution and the height of the absorbing column vary in inverse proportion to one another, the intensity of absorption remains constant. Consider two solutions of a certain pure coloured substance having the concentrations c_1 and c_2 respectively. If light from some common source be passed through a column of each of the solutions, the heights of the columns being h_1 and h_2 respectively, the columns of solution will absorb with equal intensity and therefore appear the same depth of colour when the concentrations of the two solutions and the heights of the absorbing columns stand in the following relation to one another:

$$c_1 : c_2 = h_2 : h_1$$

Thus a column 10 cm. in height of a 20% solution would appear of the same depth of colour and absorb light with the same intensity as a column 5 cm. in height of a 40% solution of the same substance. Colorimetry is based upon the above relationship and is applicable only to solutions which behave in accordance with it.

A great many coloured solutions have been investigated and found to behave in accordance with Beer's law; others show marked deviations from it.[1] In general, it may be said that coloured substances in solution obey Beer's law, unless they undergo some chemical change, such as polymerisation, dissociation, or reaction with the solvent.

The Duboscq Colorimeter and Its Use.—In common with most other colorimeters, the Duboscq colorimeter is designed to compare

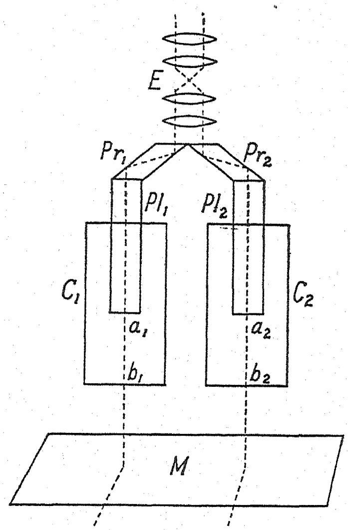

FIG. 1.

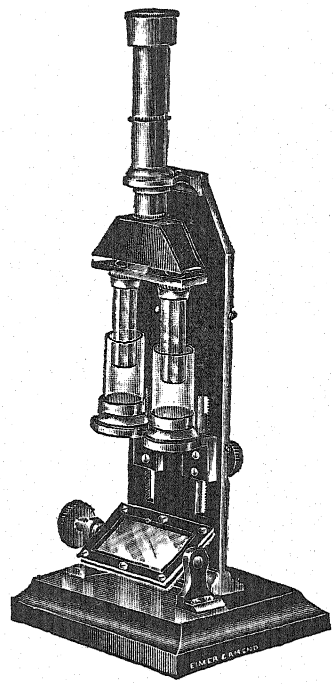

FIG. 2.—(Courtesy Eimer & Amend, New York.)

two coloured solutions of the same hue by measuring the relative heights of two columns of solution, one column of each of the two solutions, which absorb with equal intensity the light which enters them and therefore appear the same depth of tint. The appearance and essential construction of this instrument are shown in the accompanying Figs. 1 and 2.

[1] See Henrich, Theorien der Organischen Chemie, V Aufl., Vieweg, 1924, S. 344 and W. C. Holmes, *Ind. Eng. Chem.*, (1924), 16, 35.

The two coloured solutions, the standard and the solution to be compared with it, are contained in the two equal glass cups C_1 and C_2. Into these cups extend two hollow glass plungers Pl_1 and Pl_2 of equal bore and closed at the bottom with glass to prevent the liquid in the cups from entering them. Each cup[1] is fitted with a rack and pinion which permits it to be raised and lowered at will, thus altering the depth to which the plunger extends into the solution. A scale is provided by means of which the height a_1b_1 or a_2b_2 of the column of solution below the plunger may be read off, usually in units from 0, corresponding to a position in which the plunger touches the bottom of the cup, to 100, corresponding to a position of the plunger near the top of the cup. Light from some even source (usually daylight) is reflected vertically from the mirror M through the glass bottoms cf the two cups, C_1 and, C_2, containing the two solutions and along the paths shown by the dotted lines in Fig. 1. The light passes through the layer a_1b_1 of the one solution and the layer a_2b_2 of the other, in each of which a fraction of it is absorbed. From the two columns of solution directly below the plungers the light passes out of the solutions into the plungers, through the plungers and into the two prisms, Pr_1 and Pr_2, at the upper surfaces of which the two parcels of light, each of which has passed through a column of one of the two solutions, appear in the halves of a circular field upon which the observer looks down through the microscope E.

To make a colorimetric determination, the standard solution is poured into one of the two cups, and the solution to be investigated is poured into the other. Then the cup containing the standard solution is raised until the plunger extends below the surface of the liquid and set at a level corresponding to any desired number on the scale. If the standard solution be the weaker in colour of the two solutions, the cup containing it may be set at 100; otherwise it must be set at some position lower on the scale. Next the cup containing the solution under investigation is raised until the plunger extends below the surface of the liquid. Now the observer, looking down through the microscope, sees the two parcels of light, each of which has passed through one of the columns of solution, appearing in two half-circles. The colour in the half-circle above the column of solution in which the greater absorption has taken place appears deeper in tint or "darker" than the colour in the other half-circle.

[1] Frequently the cups are stationary and the plungers movable.

By raising and lowering the cup containing the solution under investigation, or, if necessary, by moving both cups up and down, the height of one or of both of the columns of solution is varied, and consequently the depth of colour in one or in both half-circles is altered until both halves of the field appear exactly the same depth of colour. The height of each column of solution is then read off on the scale and recorded. Usually four or five observations are made, the position of the cup containing the standard solution being left unaltered and the other cup moved. The mean of these readings is taken as the height of the column of the solution under investigation.

The above process will have measured the relative heights of two columns of solution of equal cross section which absorb with the same intensity. The units in which the dimensions of these columns are expressed are immaterial, since only the *relative*, and not the absolute, heights of the columns are necessary in calculating the results of the determination. In each of the columns of solution the absorption is caused by the colouring matter present in the column. Therefore, if the solutions obey Beer's law, the relative amounts of colouring matter in the two columns of solution are equivalent in colour-strength. How the results of colorimetric measurements are calculated will be seen from the following examples.

Quantitative Determinations.—To determine the percentage of pure colouring matter in a sample of dyestuff, a solution of known concentration of the sample is compared in the colorimeter with a standard solution of the same colouring matter in which the concentration of *pure* colouring matter is known. Let c_1 represent the concentration of pure colouring matter in the standard solution, c_2 the concentration of pure colouring matter in the solution of the sample of dyestuff under analysis, S the concentration of the sample in this solution, P the percentage of pure colouring matter in the sample, and h_1 and h_2 the colorimeter readings of the heights of the columns of the standard solution and of the solution of the sample respectively. Then, in accordance with the proportionality explained in the foregoing section under the discussion of Beer's law,

$$c_2 = \frac{c_1 h_1}{h_2}$$

and

$$P = \frac{100 c_2}{S} = \frac{100 c_1 h_1}{S h_2}.$$

Suppose it is desired to determine the percentage of pure colouring matter in a sample of a certain dyestuff. A solution containing 0.0200 grm. of this dyestuff per litre is compared with a standard solution which is known to contain 0.0100 grm. of the pure colouring matter per litre. A column 100 units in height of the standard solution is found in the colorimeter to be equal in strength of colour to a column 72 units in height (mean value) of the solution of the sample. Then, the concentration of pure colouring matter in the solution of the dyestuff under analysis is $\frac{0.0100 \times 100}{72} = 0.0139$ grm. per liter and the analysis of the sample of dyestuff is $\frac{100 \times 0.0139}{0.0200} = 69.5\%$ pure colouring matter. The calculation of results is simplified by employing a concentration S of the sample in the solution of the dyestuff to be analysed equal to the concentration c_1 of pure colouring matter in the standard solution. The percentage of pure colouring matter in the sample then becomes

$$P = \frac{100h_1}{h_2}$$

When the pure colouring matter is not available for making up the standard solution, a sample of dyestuff in which the percentage of pure colouring matter is known may be employed instead. In such a case the calculation of results is simplified by employing the same concentration of dyestuff (impure dyestuff in both cases, not pure colouring matter) in each of the two solutions to be compared. The percentages of pure colouring matter in the two samples of dyestuff will then be in the same proportion to each other as the concentrations of pure colouring matter in the solutions. Thus, if k represent the known percentage of pure colouring matter in the dyestuff which serves as the standard, then

$$k:P = c_1:c_2 = h_2:h_1$$

and

$$P = \frac{kh_1}{h_2}$$

Comparisons of the Colour-strengths or Values of Dyestuffs.—To determine the value or colour-strength of a dyestuff in terms of a standard, a solution of known concentration of the dyestuff in question is compared in the colorimeter with a solution of known concentration of the standard dye. The percentage of pure colouring matter in the dyes which are compared is not considered and usually

is not known. The two dyes which are compared may be either two samples of the same colouring matter differing only in their purity, or the colouring-matters of the two samples of dyestuff may be different chemical compounds. In the latter case, the colorimeter may only be used for comparing the two solutions when these are exactly, or at least very nearly, the same in hue, as every difference in hue between the two solutions involves an error in the determination. Let R represent the concentration of the dyestuff in the standard solution, S the concentration of the dyestuff in the solution which is compared with the standard, and h_1 and h_2 the colorimeter readings of the heights of the columns of the standard solution and of the solution of the dyestuff under investigation respectively. The relative parts by weight of dyestuff contained in these two columns of solution will then be h_1R and h_2S respectively. Thus h_1R parts of the standard dye and h_2S parts of the dye under investigation produce the same depth of colour and are therefore equivalent to each other. Let x represent the number of parts of the dyestuff under investigation equivalent to 1.00 part of the standard dye,

then
$$x = \frac{h_2S}{h_1R}$$

The value or colour-strength of a dyestuff may be defined as the intensity of absorption or depth of tint produced in a column of solution by a unit weight of the dissolved dyestuff. Let V_1 and V_2 represent the values respectively of the standard dye and of the colouring-matter which is compared with it. Then h_1R parts of the standard dye and h_2S part of the other dyestuff will produce the depths of colour h_1RV_1 and h_2SV_2 respectively and, since these relative quantities of the two colouring matters absorb with equal intensity and produce the same depth of colour,

$$h_1RV_1 = h_2SV_2$$

and
$$V_1 : V_2 = h_2S : h_1R$$

Suppose it is desired to ascertain the value of a certain dyestuff in terms of a standard. A solution containing 0.0150 grm. of this dyestuff per litre is compared in the colorimeter with a solution containing 0.0100 grm. of the standard dye per litre, and the relative heights of the columns of the standard solution and of the solution of the colouring-matter under investigation are found to be 90 and 80 units

respectively. Then $90 \times 0.0100 = 0.90$ parts of the standard dye are equivalent to $80 \times 0.0150 = 1.20$ parts of the other dyestuff. 1.00 part of the standard is therefore equivalent to $\frac{1.20}{0.90} = 1.33$ parts of the colouring matter which is compared with it, and the values of this dyestuff and of the standard respectively are to each other in the ratio 90:120 or 75:100. The calculation of results is simplified by employing the same concentration of dyestuff in solutions. When this is the case

$$x = \frac{h_2}{h_1}$$

and

$$V_1 : V_2 = h_2 : h_1$$

Other Colorimeters.—In addition to the Duboscq Colorimeter which, because of its ease of operation, is the most widely used type of instrument, several other colorimeters should be mentioned. In the Wolff Colorimeter the cups and plungers of the Duboscq instrument are replaced by two equal right cylinders made of glass, open at the top and closed with glass disks at the bottom. Each of the cylinders is fitted near its base with a glass cock, so that the solution contained in it may be run off, and the sides of the cylinders are graduated (usually up to 100 c.c.). In other respects this instrument is similar to the Duboscq Colorimeter. By lowering the level of the solution which appears darker (by running off a portion of it through the cock) the same depth of tint is produced in both solutions. The relative heights of the columns of the two solutions which give this tint may be read off from the sides of the cylinders. A colorimeter has been constructed by Steiger (*J. Amer. Chem. Soc.*, 1908, **30**, 215) in which the rays of light pass through the solutions contained in two glass receptacles open at the top and are reflected back from two mirrors, one of which extends down into each of the solutions. The length of the column of solution through which the light must pass before reaching the mirror is altered by moving the container. The calculation of results in connection with the use of these instruments involves nothing new.

Several types of Polarising Colorimeters are also in use. In these instruments the heights of the columns of solution through which the light passes are not altered during the determination, but the rays coming from each of the solutions are passed through a combination of prisms which polarises them, so that the rays from one

solution become perpendicular to those from the other. The relative intensities of these two parcels of polarized light are measured by means of an analysing Nicol prism. This method gives greater accuracy than can be obtained with the ordinary Duboscq or Wolff Colorimeters and is used for fine quantitative determinations. For most work with dyestuffs, however, the simpler instruments and methods are sufficiently exact.

The Lovibond Tintometer and Its Use.—The tintometer is an instrument, designed by J. W. Lovibond, by means of which colour may be measured on the fibre as well as in solution. Sets of red,

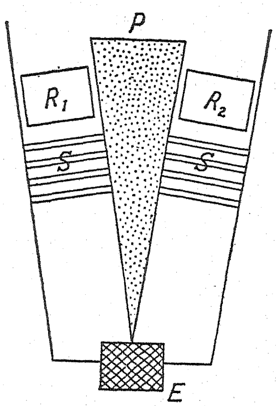

FIG. 3.

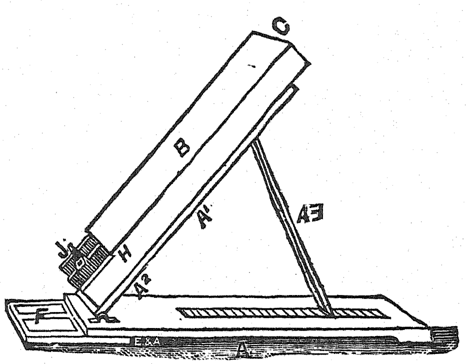

Fig. 4.—(By courtesy of Eimer & Amend, New York.)

yellow, and blue glass slides serve as the standards with which the dyed fabrics or coloured solutions are compared. All the slides belonging to a set of any colour are of the same hue, but are graduated with respect to depth of tint, each particular slide bearing a tint number. Thus it is possible to match the colour of a solution or of a dyed fabric by a combination of these numbered slides and to express this colour numerically as the sum of so many red, so many yellow, and so many blue tint units. This tintometer reading characterises the colour with respect both to hue and to depth, and may serve as a record of the colour produced upon a textile fibre under certain conditions, or in solution by the use of a certain colouring matter, concentration and length of absorbing column.

Figure 3 shows the essential features of the tintometer, and Fig. 4 the general appearance of one type of instrument. Essentially the tintometer consists of two tubes separated by a partition which ends in a knife-edge at the eyepiece E. Receptacles R_1 and R_2 are provided for solutions. In front of these receptacles the glass slides may be introduced into the field of view through the slots SS in the top of the instrument. The colour of a solution in one of the receptacles may thus be matched by an appropriate combination of coloured slides in the other tube, or the depth of colour of two solutions may be compared by the interposition of slides before the lighter-coloured solution until the colour of the other solution is matched. In either case the depth or difference in depth of colour is expressed as the total of the tint units read off from the slides. It will be seen, therefore, that, as regards its use for measuring and comparing the colour of substances in solution, the tintometer serves substantially the same purpose as the colorimeter.

When the tintometer is to be used for measuring or comparing the depth of colour upon dyed fabrics it is tilted as shown in Fig. 4 in such a way that the light is reflected back to the eyepiece from the whitened interiors of the two tubes. The pieces of material to be examined are placed at the lower ends of the tubes in place of the receptacles R_1 and R_2. To measure the depth of colour upon a dyed fabric, a piece of the dyed material is placed in one tube and a piece of white material in the other. Then coloured slides are introduced into the tube in front of the white material until the colour of the dyed material is matched. Similarly, by placing slides before the lighter-coloured of two pieces of dyed fabric until the depth of colour upon the other piece is matched, the colours of the two may be compared.

The tintometer may also be employed for the determination (*See Green, Analysis of Dyestuff*, 3rd Ed., p. 85)[1] of the percentage of dyestuff on the cloth. A graded series of dyeings in which the percentage of colouring matter on the fibre has been analytically determined are used as standards. The total tint units corresponding to each of these standard dyeings is determined and a curve is constructed by plotting the total tint units as abscissae and the corresponding percentages of dyestuff as ordinates. Given the total tint units corresponding to the depth of colour of a dyeing of unknown

[1] Charles Griffin & Co., London, 1920.

strength, the percentage of colouring matter on the cloth may then be read off from the curve.

Spectrophotometry.—The instruments heretofore discussed, the various types of colorimeters and the tintometer, all measure the absorption of white light. For this reason they cannot be employed for work with solutions containing coloured impurities which obscure the colour of the substance to be investigated or in some other cases in which the colour of the solution is a resultant colour imparted to it by two or more coloured compounds of different hue. These difficulties may frequently be overcome by substituting spectrophotometric for the simpler colorimetric methods.

Whereas with the colorimeter or tintometer all the absorption which takes place in any part of the spectrum enters into the measurement, with the spectrophotometer the absorption of light-waves lying within definite and narrow limits of wave-length is measured. In this way absorption in other regions of the spectrum, which may be occasioned by impurities or by colouring-matters other than the one under investigation, is eliminated from the measurement.

In connection with the investigation of dyestuffs the spectrophotometer is employed chiefly for determining the percentage of pure colouring matter in a sample, although spectrophotometric methods may be used for the identification of dyestuffs in some cases in which ordinary spectroscopic methods are of no avail. The reader is referred to the literature given in the bibliography at the conclusion of this article for a detailed description of these methods, as well as of the various types of apparatus, and for a more thorough treatment of the physics involved.

Spectrophotometric determinations, like other colorimetric methods, are dependent for their accuracy upon the behaviour of the coloured solution under investigation in accordance with Beer's law. Spectrophotometry, however, involves several other relations and quantities which are not considered in simple colorimetry, and of which we shall give a brief account.

The *extinction coefficient*, e, of the coloured solution under investigation is the quantity which is employed as a measure of the absorbing power of the solution in question for certain light-waves. It may be defined as the reciprocal of the length of a column of the solution in which the absorption of light of the wave-lengths corresponding to the region of the spectrum in which the measurement is made is

such that the light upon emerging from the column is reduced to one-tenth its original intensity. In other words, the extinction coefficient of a solution is the reciprocal of the length of a column of the solution which will absorb nine-tenths and transmit one-tenth of the light (of the wave-lengths for which the absorption is measured) which enters it.

If T represents the fraction of the light which is transmitted or the fraction of its original intensity to which the light is reduced by a column, h units in length, of a coloured solution, then the extinction coefficient e of this solution (measured for light of the particular region of the spectrum in which the determination is made) will be

$$e = \frac{-\log T}{h}$$ [1]

For any particular spectral region the concentration of pure colouring matter in a solution is directly proportional to the extinction coefficient of the solution, providing that the solution behaves in accordance with Beer's law. Thus, if c_1 and c_2 represent the concentrations of pure colouring-matter in each of two solutions of the same colouring matter, and e_1 and e_2 the corresponding extinction coefficients of the two solutions, then

$$c_1 : e_1 = c_2 : e_2$$

and the ratio of the concentration to the corresponding extinction coefficient will be a constant, A [2], for the colouring matter, the solvent, and the region of the spectrum in which the measurements are made. Thus, if c represent the concentration of pure colouring matter in a solution of a certain dyestuff, e the extinction coefficient of the solution measured in a particular region of the spectrum, and A the ratio $\frac{c}{e}$ of concentration to extinction coefficient for the same colouring-matter, solvent, and region of the spectrum, then

$$c = Ae$$

The spectrophotometer measures the value of T for the solution in question, and the other quantities are found by calculation. The principle of the instrument is as follows: Two beams of light of equal intensity are passed, each beam through one of two columns of liquid of the same length, one column consisting of the coloured solution under investigation, and one of the pure solvent. Having

[1] Calculations are simplified by employing a column of solution of unit length in making the measurements. T in this formula represents the *fraction*, not the percentage, of the original intensity of the light.

[2] Called by Vierordt the "Absorptionsverhältniss" or *absorption ratio*.

passed through these columns of liquid, the two beams of light are dispersed by a prism and the two spectra appear adjacent to one another in the field of the instrument. The absorption spectrum of the colouring matter under investigation will be noticeably darker in certain regions than the other spectrum. Choosing then a suitable narrow section of the spectra, not necessarily the region of maximum absorption, the lighter of the two halves of the field is darkened until it appears the same intensity as the other half. The "darkening" is carried out in such a way that it can be measured, and thus a measure is obtained of the extent to which the colouring matter in solution has reduced the intensity of the light by absorption.

The spectrophotometer is thus an ordinary spectroscope fitted with an attachment (photometer) for measuring the "darkening" described above. The photometers used are of two general types: the double-slit photometer[1] and the polarising photometer.

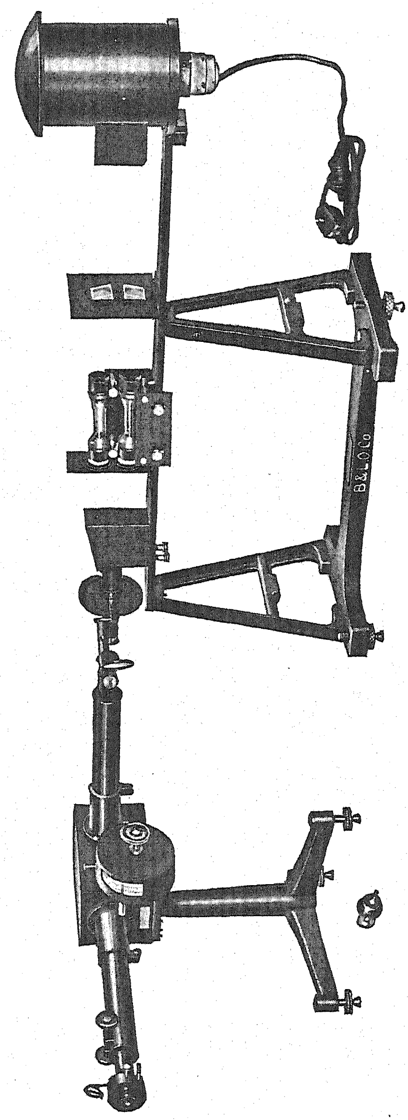

FIG. 5.—Martens Polarising Spectrophotometer. (By courtesy of Bausch & Lomb Optical Co., Rochester, N. Y.)

In the former type of photometer the measurement is accomplished by

[1] Method of Vierordt. See Krüss, *Kolorimetrie u. Quantitative Spektralanalyse.*, p. 114.

narrowing the aperture through which passes the beam of light coming from the column of pure solvent; in the latter type of instrument, by rotating an analyser prism. The exact method of making the readings and finding the value of T, the fraction of its original intensity to which the light has been reduced by absorption, differs with various instruments, and special directions accompanying the particular instrument used should cover this point.

To determine the percentage of pure colouring matter in a sample of dyestuff the value of T is determined for a solution of this dye in which the concentration S of the impure dyestuff is known. From the value of T the extinction coefficient e of the solution is found and, if the absorption ratio A is known, the concentration c of pure colouring matter in the solution may be calculated at once. If the value of A for the colouring matter, solvent, and spectral region in question are not known, it must be found by determining the extinction coefficient of a solution of known concentration of the pure colouring matter and calculating the ratio $\frac{c}{e} = A$. From the concentration c of pure colouring matter in the solution and the concentration S of the impure dyestuff in the same solution, the percentage P of pure colouring matter in the sample of dye may be calculated from the relation

$$P = \frac{100c}{S}$$

General Directions and Precautions.—The most usual solvent employed in colorimetric work is distilled water. The majority of dyes are sufficiently soluble in it, so that they may be investigated in aqueous solution. Indigo, which is itself insoluble in water, is colorimetrically (Krüss, *Kolorimetrie u. Quantitative Spektralanlyse*, S. 86) and spectrophotometrically (Krüss, *Kolorimetrie u. Quantitative Spektralanalyse*, S. 241. Wolff, *Z. anal. Chem.* **17**, 65; **23**, 92) determined in aqueous solution in the form of its sulphonic acid, and such a method might conceivably be used in other cases. Alkalies may also be used as solvents for certain classes of dyestuffs, such as the Alizarines. Alcohol, petroleum spirit, hexane, and a great variety of other solvents may be employed in special cases. For the accuracy of determinations with the colorimeter it is, of course, necessary that the absorption due to the solvent be negligible. In work with dyestuffs it is usually safe to assume this to be the case;

in very careful work compensation may be made for the influence of the solvent (Krüss, *Kolorimetrie u. Quantitative Spektralanalyse*, S. 69).

The best concentration to be used for any particular investigation is a matter of experiment. Dyes are always investigated in very dilute solutions, usually 0.01–0.05 grm. of colouring matter per litre of solution. The concentration of solutions investigated in the colorimeter should be such that a difference of 2 or 3 units in the height of the column of solution is clearly visible in the depth of colour. Errors due to small deviations from Beer's law and to absorption on the part of the solvents can be diminished by avoiding great differences in the concentrations of pure colouring matter in the solutions to be compared. For spectrophotometric determinations a concentration such that 0.7–0.9 of the light will be absorbed in passing through the column of coloured solution has been found to give the most satisfactory results. Care should be taken to keep standard solutions in tightly stoppered bottles to guard against evaporation of the solvent.

Before being colorimetrically examined solutions should be at room temperature and should be clear from traces of suspended material. To insure this, they may be filtered through parchment filters.

Equal illumination of the solutions or dyed fabrics under examinations, of course, a necessary condition for the accuracy of determinations made with any of the above instruments. To insure the fulfilment of this condition, the colorimeter should be placed in position before the source of light and the observer should first look through the eye-piece before the solutions are placed in the cups. If one half of the circular field appear darker than the other, then the illumination on both sides is not equal and should be made so by moving the mirror or the whole instrument into such a position that the two halves of the field of vision appear equally light. In like manner the tintometer should be so adjusted in relation to the light source that both fields will be equally illuminated. Correct illumination for the spectrophotometer can be insured by adjusting the position of the light source in relation to the other parts of the outfit.

Daylight is generally the best source of illumination for work with the colorimeter and the tintometer; direct sunlight, however, is to be

avoided. Artificial light, frequently an electric bulb, is employed in connection with the spectrophotometer.

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DYES AND COLOURING MATTERS

BY HANS EDWARD FIERZ-DAVID (ZÜRICH)

Introduction.—The great variety of artificial Dyestuffs rendered it necessary to arrange the material in a new fashion. There are many possible arrangements, but I have found it the most practical to adopt the method of **Schultz's "Farbstofftabellen"** which are classical, and which have been copied with but very slight variation in the great *"Colour Index."* In order to facilitate reference it has been found useful to proceed on the lines of the "Colour Index," although Schultz's arrangement seems to the writer often more practical. I have noted the different dyes in the order given by the Colour Index and have given in the *Remarks* the necessary indications for practical use. It must always be borne in mind, comparatively, that only very few of the numerous dyestuffs known are actually in use. I have given those which are often met with in large print, and those which are seldom used in smaller characters.

Identification of Dyestuffs.—The identification of commercial dyestuffs on the fibre will be given in another section, and the reactions of each dyestuff, as given here, are those observed on using the free compound. Thus it is evident that alizarine, for instance, is not a dyestuff in the pure state, since "Turkey-red" is a very complicated mixture of alizarine, fatty acids, lime and alumina. On the other hand, in very many cases the reactions of the dyestuff and its dyeing are identical.

Great importance must be attached to on the **Absorption-spectrum,** because this is in very many cases the quickest means of identifying a particular compound. I have given all the Absorption bands available, and many of them have been verified or corrected when it was found necessary. (See also Formánek, J., *Untersuchung und Nachweis organischer Farbstoffe auf spektroskopischem Wege. Berlin, Springer* (1908) *2nd Ed.*)

The old method of arrangement, which consisted in dividing the different dyes according to their affinity towards the textile fibres, and which was partly followed in the last edition has been completely abandoned, because very many colouring matters belong to the same chemical group, but have very different dyeing properties. The present arrangement proceeds on purely chemical lines, being the only one which permits of a satisfactory classification.

CHEMICAL IDENTIFICATION OF THE DIFFERENT GROUPS

Preceding each group are given the most characteristic reactions which, in *many cases*, allow of the classification of a given material. It must, however, be pointed out that such identification is often very difficult (see the Identification of Dyestuffs on the Fibre), and in certain cases impossible without very long systematic research. The detection of certain bases, such as benzidine, *o*-tolidine, *o*-dianisidine or aniline is very simple, but the detection of the more complicated compounds, such as amido-H-acid, amido-cresidine, etc., etc. is impossible for those who are not accustomed to this very delicate work. *If a given dyestuff cannot be identified with one of the dyes given in the following tables it may be said that it is not possible to find out its exact constitution.* Nevertheless, it has been found that dyes which are not identical with a known dye can yet often be classified as being *very closely related* to certain substances—a fact which often helps the practical man.

For those who are interested in the determination of the composition of an unknown dyestuff the following directions may be useful:

1. The class of the dyestuff is first determined by the reactions given in the following tables.

2. When it has been found out to which group the substance belongs, it has to be found out whether it is not identical with one of the compounds already known.

3. In the case of azo dyes the method is as follows:

The dye is first extracted with 10% hydrochloric acid until no more soluble salts are removed. Then the substance is reduced with metallic tin and hydrochloric acid until it is colourless. After this, the colourless liquid, or suspension, is electrolysed in a porous cell surounded with dilute hydrochloric acid. The tin is thus deposited on the copper cathode, and the liquid is freed from tin. The liquid is then concentrated in a vacuum until all the hydro-

chloric acid is removed. The residue is next crystallised in fractions, and each of these fractions is compared with the substances known to be formed by the reduction of azo dyes. Derivatives of certain substances are made, such as benzoyl-aminocresidine, aminosalicylic acid, etc. The amino-naphtholsulphonic acids are characterised by the form of their crystals and also by their colour reactions on moist filter paper. Each of these numerous derivatives gives very characteristic shades with water and air, with or without ammonia. These reactions are very sensitive and often very difficult, because the slightest difference in concentration leads to different results. Nothing has been published so far which would allow one to state exactly how this analysis is to be conducted, and without having all the "decomposition products" in hand it is not possible to undertake this work. It must also be said that such an analysis has to be made with about 50 grm. of dyestuff, and very often only small fractions of a grm. of pure derivatives can be isolated. This method has been elaborated in the continental dyeworks and is only known to comparatively very few people.[1]

HISTORICAL OUTLINE

Until the middle of the 19th century, nearly all the colouring matters used for dyeing were either such as existed ready-formed in the vegetable or animal kingdom, or were producible from natural products by very simple chemical processes. In a few cases, however, as when lead chromate or Prussian blue was formed as an insoluble precipitate in the fibre, the dyes were strictly of artificial origin. Now, the vast majority of the colouring matters used as dyes—as distinguished from mere paints or pigments—are products of organic

[1] The author has elaborated a method which was published in his book: *Künstliche organische Farbstoffe*, Berlin, Springer [1926].

According to Green's directions (see his *Analysis of Dyestuffs*, 1921) it has to be ascertained which reducing agent is best suited for the "splitting" of a given Azo-dyestuff. It has, however, been found that it is best always to reduce with tin and hydrochloric acid. The dyestuff has to be purified, as far as possible, from salts, and mixtures of dyes cannot be analysed with any certainty of a definite result. Reduction takes place at 50–80°, and at least 50 grm. of pure dyestuff have to be taken for one analysis. When the solution or suspension has become colourless the mass is placed in a porous cell surrounded by dilute sulphuric acid, and is electrolysed with a current of 4 volts and about 5 amp. at 50° until all the tin is deposited on the copper cathode. The resulting liquid or suspension is then at once evaporated *in vacuo* at 25° in order to remove the excess of acid. The resulting solid residue is treated with cold distilled water, and the different compounds are crystallised in fractions. This work is very difficult and tedious in practice. The pure fractions thus obtained are treated with dilute ammonia and dilute sodium hydroxide on filter paper, and the different colorations are compared with those obtained by the known amido-compounds. Details must be studied in Green's tables. Bases are identified by their benzoyl derivatives or other characteristic compounds. (Glyoxalines, obtained with phenanthrenequinone, tetrazo compounds, acetyl derivatives, etc., etc.)

synthesis, being in almost all cases obtained, by a series of highly involved processes, from coal-tar.

Picric acid and aurin are the oldest of the coal-tar colours, but the coal-tar colour industry may be said to date from 1856, when Perkin accidentally discovered the violet dye called mauve in the course of an investigation having as its object the synthesis of quinine. In 1859 Hofmann synthesised Aniline Red (magenta), and in the following year Verguin manufactured it in quantity. In 1860, rosaniline or magenta first became of commercial importance, owing to the simultaneous discovery of the arsenic-acid process by Medlock and Nicholson. Phenylated blues were first produced by Girard and DeLaire in the same year, but their insolubility rendered their application limited until Nicholson, in 1862, discovered a method of rendering them soluble by conversion into sulphonic acids. The first azo-dye, amino-azobenzene, was introduced by Simpson, Maule, and Nicholson in 1863, under the name of Aniline Yellow, and in the same year the methylated and ethylated rosanilines, known as Hofmann's Violets, were manufactured by the same firm. Aniline Black, also, was discovered by Lightfoot in 1863. Azo-diphenyl Blue, the first of the colouring matters now known as indulines, appeared in 1864, as also did dinitronaphthol or Manchester Yellow. In 1866, triamino-azobenzene or Bismarck Brown was first made, and in the same year Coupier's nitrobenzene process of manufacturing magenta was introduced. In 1868, Graebe and Liebermann announced their discovery of the constitution of alizarin, and in the following year this colouring matter was first manufactured from anthracene. Galleïn and fluoresceïn were discovered in 1871, and in 1874 tetrabromofluoresceïn was introduced as a dye by Caro, under the name of eosin. Diamino-azobenzene or chrysoïdine was introduced by Witt in 1875. Methylene Blue and Acid Magenta were introduced by Caro in 1877, and in the same year the fugitive Aniline Yellow was rendered valuable and stable by Grässler, by conversion into a sulphonic acid. In 1878, the tropæolins, Fast-red, Naphthol-scarlet, and other sulphonated azo-colours were first manufactured; and Malachite Green dates from the same year. In 1879, the first of the secondary azo-dyes appeared under the name of Biebrich Scarlet. The synthesis of indigo was effected by Baeyer in 1880, and indophenols were introduced by Koechlin and Witt in 1881. In 1883, Caro's process of manufacturing colouring matters

of the rosaniline group by the aid of phosgene gas was patented. Congo-red, the first of the numerous class of benzidine dyes, which dye cotton without a mordant, was patented by Böttiger in 1884, and this was followed in the same year by Chrysamin. In 1885, Azo-blue and Benzazurin appeared, and in 1886 the Benzopurpurins were patented. Numerous other dyes are constantly appearing, and in many cases they exceed in fastness, brilliancy, or cheapness those already in the market.

In 1894 Vidal patented the first sulphide dyestuffs, obtained by the action of sulphur and sodium sulphide on aromatic amino- and hydroxy-compounds, and in 1901 Bohn's discovery of the production of indanthrene, the first of a new class of vat dyestuffs, was patented. The progress since 1900 has been very remarkable. The old dyes have been replaced to a very great extent by the new and faster products. New azo dyes of excellent fastness have been discovered, such as derivatives of J-acid (Aminonaphtholsulphonic acid 2.5.7, 2.8.6, etc.) and the dyeing of cotton fabrics has been revolutionised. The vat dyes have been multiplied, thanks to the work of *Friedländer*, who discovered thioindigo red and numerous green, violet, scarlet and black vat dyes are known which are almost indestructible. At the same time the vat dyes of anthraquinone have played a very important rôle, and the sulphur dyes have been completed to a remarkable extent. The methods of application have also been modified to a certain extent. Thus β-naphthol has been replaced partly by naphthol A. S, (the anilide of 2.3-oxynathoic acid) in the preparation of *p*-nitraniline red, and many of the azo dyes which are treated on the fibre with chromium salts are found on the market in the form of their complex double-salts (Neolan colours, lanasol colours, erganon colours). The dyeing with vat-dyes is also very often simplified, because these substances are now on the market in the form of their reduction products (leuco-compounds). This change is still going on, and it may be expected that within 20 years many of the old fugitive shades will have practically disappeared.

RELATIONS OF COLOURING MATTERS TO FIBRES

While the chemist defines dyestuffs and colouring matters as acid, basic, or neutral, the dyer classifies them according to their behaviour with fibres. Thus, excluding indigo, aniline black, Prussian blue, and a few other colouring matters such as the "ingrain" dyes

which are produced by some chemical reaction occurring within the fibre itself, dyes may be classed as substantive or direct, and adjective or mordant.

Substantive dyes are absorbed directly from their solutions by the fibre, without requiring the intervention of a mordant. The animal fibres (*e. g.*, silk and wool) possess an affinity for most of the coal-tar colours, and in many cases under the conditions of dyeing absorb them so completely that the dyebath is rendered colourless. Many colouring matters are taken up by animal fibres more readily from an acid than from a neutral bath; and in such cases the bath is usually acidified with sulphuric, acetic, formic, lactic, or tartaric acid. If sulphuric acid is used, sodium sulphate is generally added also. Some dyers add acid sodium sulphate as such, instead of forming it in the dye-bath. In wool-dyeing, sodium or magnesium sulphate is often added to the bath, possibly to reduce the solubility of the colouring matter and to obtain faster and more even colours. In some cases, as when wool is dyed with alkali-blue or cotton with indigo, a colourless neutral substance is absorbed by the fibre, and is only converted into a coloured compound by a subsequent chemical action, namely, the liberation of the free sulphonic acid in the first case and oxidation to indigo-blue in the latter.

The **"ingrain colours"** produced on cotton by means of primuline and other compounds afford a remarkable example of the building up of a dye within the fibre.

Unmordanted cotton is not dyed by the ordinary basic dyestuffs or acid wool dyestuffs, but is dyed by the direct cotton or "salt" dyestuffs which are mainly derivatives of tetrazotised benzidine and derivatives; it is also dyed from alkaline liquids containing reducing agents in presence of air, by indigo and its derivatives, and by other vat-dyestuffs such as indanthrene. During recent years the sulphide dyestuffs have come into great prominence; these dye unmordanted cotton from a bath containing alkaline sulphides in solution, with the help of atmospheric oxygen.

Adjective Dyes.—In many cases, cotton and other vegetable fibres can only be dyed through the intervention of a mordant. Sometimes the mordant acts by forming an insoluble compound with the colouring matter, according to a definite chemical action; and in other cases it simply serves as a medium on which the colour is adsorbed. In some cases, colouring matters which have themselves

been fixed on the fibre act as mordants for others. Thus the benzidine dyes may be employed for mordanting the basic aniline dyes on cotton. Several useful combinations are thus obtainable.

The proteins resemble silk and wool in their affinity for coal-tar dyes, and hence albumin, etc., are employed in calico-printing. A solution of albumin mixed with the colouring matter is printed on the cotton fibre. On steaming, the albumin is coagulated and the colour becomes fixed.

Tannin acts as a mordant for basic dyes, as it forms witn them insoluble tannates.[1] These compounds are soluble in acetic acid or

	Dye	Tannic acid	Sodium carbonate crystals
Magenta	4	5	2
Malachite green	4	5	1
Parma	4	5	1
Methyl green	4	10	4

alcohol, and if the solutions thus obtained are thickened with starch or dextrin and printed on cotton, the tannate becomes fixed and insoluble on steaming the goods. Better results are obtained by employing, in conjunction with the tannin and colour-base, a metallic salt (*e. g.*, tartar emetic, stannic chloride, lead acetate, etc.) capable of yielding an insoluble tannate.

The use of oils in dyeing Turkey-red is a familiar example of the application of oil mordants, which are generally employed in conjunction with inorganic mordants. This class includes the so-called soluble oil.

The acetates of iron (ferric), aluminium, and some other metals undergo decomposition when heated, with formation of free acetic acid and insoluble basic acetates. Hence these metallic acetates act as valuable mordants, especially for silk; they also become perfectly fixed on cotton by steaming. The thiocyanates are also used for a similar purpose.

Wool is usually mordanted with chromium or aluminium compounds; the former are obtained by the use of alkali dichromate in conjunction with tartaric, sulphuric, oxalic, or lactic acid, or of chromium fluoride. Other salts also have been used.

CLASSIFICATION OF DYES AND COLOURING MATTERS

The following arrangement of the colouring matters is based on purely scientific lines. Nearly all the dyes used are derivatives of

[1] The tannates of the colour-bases may be either soluble or insoluble, according to the proportions used.

aromatic compounds such as benzene, naphthalene, anthracene, quinoline and carbazole. The general classification which is chosen was first proposed by Nietzki, who arranged the dyes according to the groups which cause strong absorption of parts of "white light."

These groups are numerous, and, following Schultz and the Colour Index, the dyes are classified as follows:

1. Nitroso Colouring Matters and Nitro-colouring Matters.—These compounds are mostly yellow or brown. On heating they decompose rapidly, often with slight explosion, which makes them rather dangerous to investigate. Attention should be drawn to the fact that many Azo dyes contain also *Nitro-groups* or *Nitroso-groups* (anthracene Chrome Brown, Metachrome Brown, etc.). These dyes are often very explosive and must be handled with caution. Some of the Nitroso dyes are regarded as quinone-oximes, but all give the Liebermann reaction (blue coloration with sulphuric acid and phenol) well defined in all stages.

The Nitroso-group (NO_1) and the Nitro-group (NO_2) are reduced by strong reducing agents to the Amido-group (NH_2). The same applies to the Azo-dyes, and the distinction between Azo dyes and Nitro or Nitroso dyes is often not easy.

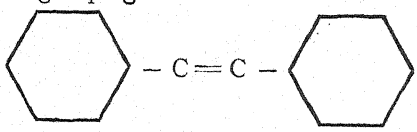
2. Azo-colouring Matters, which Include Mono- and Poly-azo Dyes.—This class is by far the most numerous of all dyestuff classes and about 70% of all dyes in use belong to this group.

All azo dyes contain the group =

$$-N=N-, \text{ namely, the Azo group.}$$

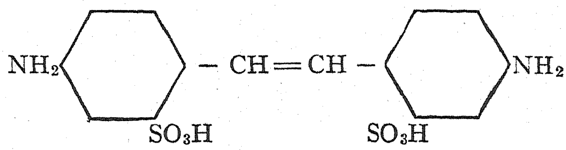
All azo dyes are reduced by strong reducing agents, forming amino-compounds, which can be identified (see introduction page 2).

3. Stilbene Colouring Matters.—The stilbene colouring matters contain the grouping:


i.e. Stilbene.

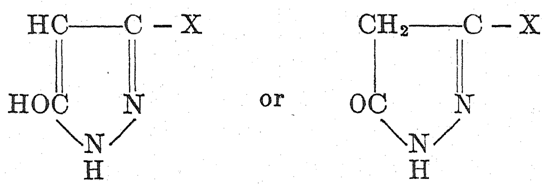
The stilbene dyes may also be regarded as azo dyes or azoxy-dyes, but it is preferable to regard them as a separate group which has characteristic properties. The stilbene azo dyes have, with the exception of the azo dyes made from diaminostilbene-di-sulphonic acid, the property of dyeing cotton fabrics in weakly alkaline solution, leaving silk and wool perfectly white. This renders them very

useful for dyeing union goods. All stilbene dyes are reduced by very strong reducing agents, such as zinc dust and sodium hydroxide, or ammonia and hydrogen sulphide, to amines of unknown (or little known) constitution and diaminostilbenedisulphonic acid:



This acid is practically insoluble in water and is easily recognised by "tetratotising" and coupling with phenol in alkaline solution. The disazo dye thus obtained gives with concentrated hydrochloric acid a blue coloration.

4. **Pyrazolone Colouring Matters.**—All pyrazolone colouring matters are derivatives of pyrazolone, and in most cases of phenyl-X-pyrazolone, when X is CH_3 or COOH.



phenolic form　　　　ketonic form

Pyrazolone dyes are made from dioxy-tartaric acid or in modern dye works exclusively from pyrazolones obtained from arylhydrazinenes and acyl-acetic esters. (Oxalyl-acetic ester, aceto-acetic esters etc.)

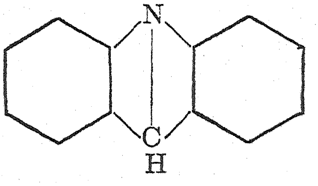
All pyrazolone dyes are yellow to orange. Some of their chrome-lakes are red.

5. **Carbonium-colouring Matters.**—These include diphenylmethane dyes, triphenylmethane dyes, xanthene colouring matters (Rhodamines, Fluorenes, Pyronines, or Phthaleins).

These dyes are regarded as derivatives of trivalent carbon quinoid or complex. Diphenyl- and triphenylmethane dyes may be *discharged* with rongalite or hydrosulphite, whilst the phthaleins, as a rule, resist this treatment. Moderate reducing agents reduce this class to leuco-derivatives which are reoxidised by air to the original dyestuff.

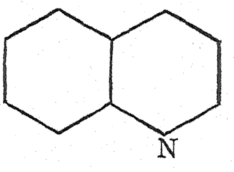
The group of the carbonium dyes comprises the individuals which give the most brillant shades known, but their fastness is, as a rule, very unsatisfactory.

7. Acridine Colouring Matters.—The acridine dyes have acridine as their parent substance:



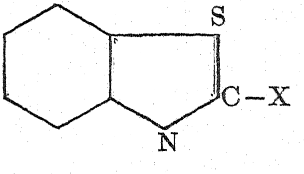
Acridines invariably show a *strong blue fluorescence.* They are yellow to orange and are of great importance in the manufacture of leather, as well as in the printing trade. Some of them are strong disinfectants.

8. Quinoline Colouring Matters.—Quinoline colouring matters contain the quinoline nucleus:

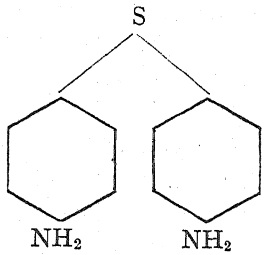


With the exception of Quinoline Yellow, they are of little importance for dyeing textile fabrics, but as sensitisers for photographic work they are of very great importance.

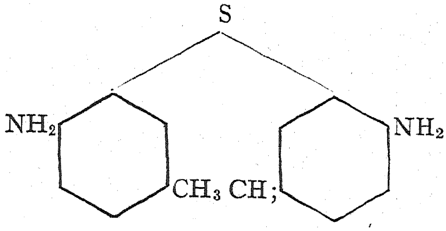
9. Thiazole Colouring Matters.—The thiazole colouring matters contain the thiazole ring; for instance:



Thiazoles form a small but important group of dyes which dye cotton without a mordant. Some of them cannot be discharged with rongalite or hydrosulphite. On distillation with zinc dust all of them yield thio-bases, such as thioaniline or thio-*p*-toluidine:



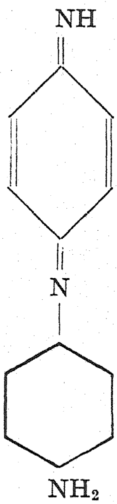
M. P. 105



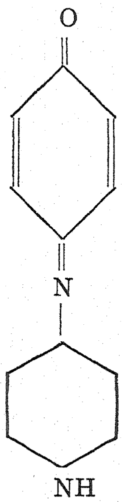
M. P. 103.

10. Indamine Colouring Matters, Indophenol Colouring Matters. Indoaniline Colouring Matters.—The numbers of this group have no importance as technical dyes, but are of great importance for the manufacture of "Sulphur Dyes."

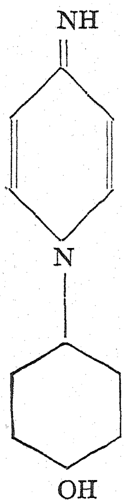
These substances may be regarded as derivatives of quinone-imides.



Indamine

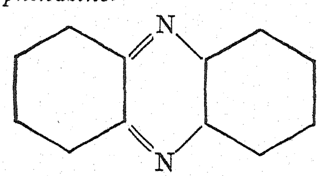


Indophenol



Indoaniline

11. Azine Colouring Matters.—This group contains the azine ring and is derived from *phenazine:*

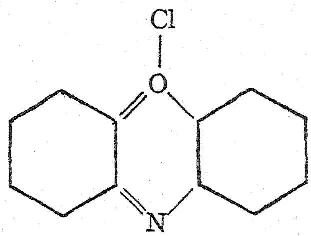


M. P. 171° (yellow needles)

Azine colours resist moderate reducing agents very well and are reoxidised by air, forming the original dyestuff.

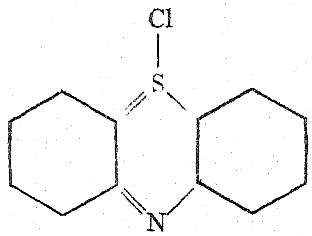
This group is divided into several sub-groups which will be found later under the description of the commercial products.

12. **Oxazine Colouring Matters.**—This group is derived from the oxazine ring:



Phenoxazonium chloride. The free base is unknown, because it changes immediately into a hydroxy-phenoxazone (or quinoid cxygen-derivative of such). These dyes are reduced by hydrosulphite, forming stable leuco-derivatives.

13. **Thiazine Colouring Matters.**—This group is derived from phenazthionium chloride:



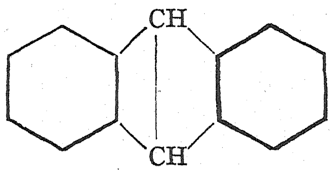
Thiazines are reduced by hydrosulphite, forming stable leuco-derivatives, which can be printed like the leuco-derivatives of the oxazines.

14. **Sulphur Colouring Matters.**—The sulphur colours are of unknown constitution, but are probably related to the thiazines. They are a kind of vat-dyes, being soluble in sodium sulphide solution, from which they dye cotton in fast shades.

15. **Hydroxy-ketone Colouring Matters.**—The hydroxy-ketone colouring matters are derivatives of different constitution; some are benezene derivatives, others are naphthalene compounds.

16. **Anthraquinone Colouring Matters.**—All Anthraquinone dyes are derived from anthracene. **All give, on distillation with zinc dust,**

Anthracene, or a simple Anthracene-derivative *e. g.* Anthracene-quinoline, Benzanthrene, etc.

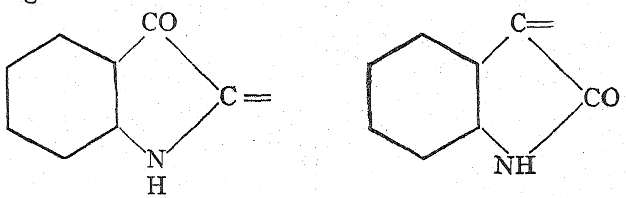


$C_{14}H_{10}$ (M. P. 213°), Colourless leaflets with blue fluorescence.

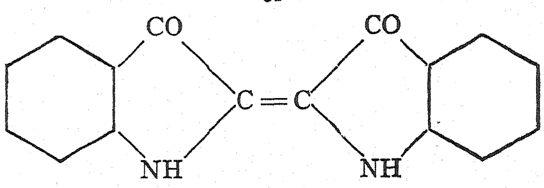
The anthraquinone dyes belong to very different classes of dye-stuffs, including acid dyes, mordant dyes and vat dyes. Anthraquinone dyes are among the most important dyes and gain constantly in importance on account of their remarkable fastness. Many dyes are called "anthracene or anthraquinone dyes" without foundation, and it is always necessary to make sure that a substance thus called is really a derivative of anthracene. Care should be taken when making the zinc dust distillation, because certain azo dyes (Anthracene Black, Brown etc.) *detonate when heated with metallic zinc.*

The individual properties of the anthracene dyes are given later.

17. **Indigo Colouring Matters.**—Indigo colouring matters are vat dyes of different constitution, but, as a rule, they contain the grouping:



or



Indigotin

Index of Names of Firms

(A) Aktiengesellschaft für Anilinfabrikation, Berlin.
(AAC) American Aniline Co. Albany (Formerly Bayer).
Hudson River Anilineworks, Albany, formerly Bayer, then again Bayer (1924).
(AW) A. Wiescher & Co., Belgium.
(B) Badische Aniline and Sodafabrik, Ludwigshafen, Germany.
(BDC) British Dyestuff Corporation, Huddersfield, England.
(BACo) British Alizarine Co., England.
(BK) Beyer und Kegel, Leipzig.
(By) Bayer & Co., Elberfeld-Leverkusen, Germany.
(C) Cassella & Co. Mainkur near Frankfurt o/M. Germany.
(ClCo) The Clayton Aniline Co. (Now belongs to the Basle Firms).
(CJ) Carl Jäger, Düsseldorf, Germany.
(CR) Clauss & Rée, Clayton, Manchester.
(DH) Durand & Huguenin, Basle.
(Du Pont) Dyestuff Manufacturer, Wilmington, Delaware, U. S. A.
(FTM) Fabriques de Thann et Mulhouse, Alsace, France.
(G, or Gy) Geigy & Co., Basle.
(Gr) Griesheim-Electron, with which is amalgamated, Oehler.
(H) Read Holliday, which was amalgamated with the British Dyestuff Corporation and which has started a new business in Huddersfield.
(N) Compagnie Nationale des Matières Colorantes. Has Several works and was intimately connected with the German Dyestuff Works.
(HM) Heller and Merz, N. J., U. S. A.
(J, or CIBA) Gesellschaft für chemische Industrie, Basle.
Or. S. C. I. Society of Chemical Industry, Switzerland.
(K) Kalle & Co., Biebrich on the Rhine, Germany.
(Ki) Kinzelberger, Prague, C. S. R.
(L) Leonhard & Co., Mühlheim on the Rhine, Germany.
(LD) Lepetit Dollfuss & Gansser, Italy.
(Lev) Levinstein Ltd., which is now amalgamated with the British Dyestuff Corporation.
(M) Meister, Luzius und Brünning, Höchst on the Main.
(MLy) Manufacture Lyonnaise des Matières Colorantes.
(NF) Neederlandsche Kleurstoffen Fabriek, Nardeen, Holland.
(P, or St. D.) Société des Matières Colorantes à St. Denis, Paris.
(RWCo) R. Wedekind & Co., Uerdingen on the Rhine.
(S) Sandoz, Basle.
(Sch) Schöllkopf, Buffalo, now The National Aniline Co., U. S. A.
(Scotch) Scottish Dyestuff Co., Glasgow.
(t. M.) Weiler ter Meer, Uerdingen on the Rhine, Germany.
(W) Williams Brothers, Hounslow, Middlesex, England.
(WDC) Wülfing Dahl & Co., Barmen, Germany.

Important Note.—The names of the Firms are abbreviated. Many new firms have arisen, and most of them are only manufacturing the old products under a new name. The German dye-works have recently completely changed the names of many important old and new products, and only a very exact investigation of a product can prove its identity. **The Spectrum** is often the only sure means of establishing the constitution of a dye.

I. NITROSO COLOURING MATTERS AND NITRO-COLOURING MATTERS

No. 1–14

Fast Green O. (H). (MLB) *Alsace Green* (CN) *Dark Green* (B) (C) *Dinitroso Resorcinol* *Dioximinoquinone* *No.* 1 (1)	A dark green paste or greenish-brown powder. The dry power is explosive. Crystallises from dilute alcohol in yellowish-brown plates, $+2H_2O$; deflagrates at 115°. It is an acid, liberating CO_2 from carbonates, and forms two series of salts. Partial absorption in blue and violet. Not characteristic. H_2O: sparingly soluble cold, more readily hot. HCl: unaltered. NaOH: aqueous solution darkened. H_2SO_4: pale yellow solution, which brightens on dilution. Dyes iron-mordanted cotton green, fast to ironing; chrome-mordanted a somewhat faster yellowish-brown, nickel-mordanted bright brown; cobalt-mordanted orange. Used to a limited extent in calico printing as indicated for No. 2. Cotton padded with an alkaline solution and steamed is dyed a fast brown which serves as a mordant for basic dyes. Iron-mordanted wool is dyed dark green, very fast to washing, but little used. Light: 1–2.	
Fast Printing Green (BDC) (By) (K) (A) Naphthol Green Y (BEL) Gambine (A) (K) Nitroso Beta-naphthol (SCC) Steam Green G (B) α-nitroso-β-naphthol No. 2 (2)	An olive-green paste. Crystallises from dilute alcohol in plates or orange-brown prisms, M. P. 109.5°. Volatile with steam when pure, but resinifies on boiling with water when impure. H_2O: slightly soluble with a yellow colour. Alcohol: reddish-yellow solution. HCl to aqueous solution: unaltered. NaOH: greenish-yellow fluorescence. H_2SO_4: dark brown solution, brown flocculent precipitate on dilution. Light: 2–1. Dyes iron-mordanted cotton green, fast to light; chrome-mordanted cotton brown, less fast. The bisulphite compound *Naphthine S* is used in calico printing on a ferrothiocyanate mordant for fast green shades. Used to a limited extent in calico printing for the production of fast shades of green, brown, drab and rich terra-cotta, with iron, chromium nickel and cobalt mordants, respectively.	

Gambine R (H) (L) *β-nitroso-α-naphthol* *No.* 3	A greenish-yellow paste. Crystallises from hot water in yellow needles, M. P. 152°. H_2O: slightly soluble, with a yellow colour. Alcohol: yellow solution. HCl to aqueous solution: unaltered. NaOH: clear yellow solution. H_2SO_4: intense red-brown solution, yellow solution and brown flocculent precipitate on dilution. Light: 1–2. *Dyes* iron-mordanted fabrics green; chrome-mordanted Dutch-brown; very fast to light and washing. *Used* to a limited extent in calico printing as indicated for No. 2.	*Notes* Remarkably fast to soaping.
Gambine B (*H*) *Dioxine* (*L*) *l-nitroso-*2:7*-dihydroxy-naphthalenc* No. 4 (3)	A red paste. H_2O: difficultly soluble. Alcohol: yellowish-red solution. Dilute NaOH: deep brownish-red solution. H_2SO_4: green solution, red precipitate on dilution. Dyes iron-mordanted cotton bright green; chrome-mordanted brown; very fast to light: Light: 2–1. Used to a limited extent in calico printing as indicated in No. 2.	Scarcely used to-day.
Naphthol Green B. pdr. and paste. B (BDC) (C) (EM) New Fast Acid Green (JC) Ferric sodium salt of 1-nitroso-2-naphthol-6-sulphonic acid No. 5 (4)	A dark green powder, which leaves a residue of iron sulphide on ignition. Partial absorption in blue and violet. H_2O: yellowish-green solution, which decomposes on long standing. HCl: yellow on warming. NaOH: bluish-green colour. H_2SO_4: yellowish-brown solution, yellow solution on dilution, which gives a precipitate of Prussian blue on adding potassium ferro and ferricyanide. Dyes wool green from an acid bath containing an iron salt. Light: 2–3. Used in wool dyeing and pigment manufacture.	The only nitroso-dye of a certain importance.
Naphthol Green G (Lev.) Ferric sodium salt of 2-nitroso-1-naphthol-4-sulphonic acid No. 6	A dark green powder, or bluish-green crystalline plates when pure. A residue of iron sulphide is obtained on ignition. H_2O: less soluble than No. 5, and the solution is a yellower shade of green. HCl: yellow on warming. NaOH: unaltered. H_2SO_4: yellowish-brown solution, yellow solution on dilution and separation of yellow needles; precipitate of Prussian blue on adding potassium ferro- and ferri-cyanide. Light: 2–3. Dyes wool a yellower shade of green than No. 5 from an acid bath containing an iron salt.	Used as No. 6.

Picric Acid (Gr) (H) (DH) (A) (Gr E)
Symmetrical trinitrophenol
No. 7 (5)

Light yellow crystalline leaflets, (M. P. 122.5) which burn vigorously.
Partial absorption in blue and violet.
H_2O: sparingly soluble cold, more readily soluble hot.
The greenish-yellow solution has a bitter taste and is poisonous. Light: 4.
Alcohol: (ether, benzene etc.): readily soluble. HCl: unaltered. Boiled with KCN: brown solution of potassium isopurpurate. Na_2S: reduced to picramic acid, 2-amino-4:6: dinitrophenol. NaOH: dark yellow solution. H_2SO_4: yellow solution, unaltered on dilution. HNO_3: yellow solution.
Dyes: wool, silk, and leather from an acid bath, greenish-yellow, not fast to washing or water, and the shade becomes a dull orange on exposure to light.
Used to a slight extent in silk dyeing for shading and for compound colours, although now largely replaced by other yellow dyes. Chiefly used as an explosive under the British name of Lyddite, the French name of Melinite, the Japanese name of Schimose &c., and formerly in photography as a light filter.

Very important as an intermediate HP for picraminic acid and certain reddish sulphur-blacks.
Estimation of Picric acid.
In addition to the method of titration given in Vol. 3, free picric acid may also be titrated by taking advantage of its power of liberating iodine from a solution containing potassium iodide and iodate; in this respect it acts as a mono basic acid and each c.c. of *N*/10 thiosulphate solution is equivalent to 0.0229 grm. of picric acid. The liberated iodine is titrated in the usual manner with thiosulphate solution, starch paste being used as indicator; the picric acid in picrates may be estimated by acidifying with hydrochloric acid, extracting with benzene, evaporating the extract and dissolving the residue in water; this solution is then titrated as above (E. Feder, *Analyst*, 1906, 31, 368).
M. Busch and G. Blume (*Z. angew.*

Chem., 1908, **21**, 354) estimate picric acid by means of nitron, the well known quantitative reagent for nitrates, 1.4-diphenyl, 3.5-endanilo-dihydrotriazole,

Nitron picrate is practically insoluble in water. About 150 c.c. of a solution of the substance containing not more than 1 grm. of picric acid per litre, are acidified with 1 to 2 c.c. of dilute sulphuric acid, heated to boiling and treated with 10 c.c. of a 10% solution of nitron in 5% acetic acid. The reagent is added slowly. Aftercooling, the lemon-yellow needles of nitron picrate are collected in a Neubauer crucible, washed with 50–100 c.c. of cold water, and dried for 1 hour at 100°. Equal molecules of the nitron and picric acids are combined in the precipitate, and the weight obtained must therefore be mul-

		tiplied by $229/541$ in order to convert it into weight of picric acid. When necessary, alcohol may be used for solution. In presence of hydrobromic, hydriodic, chloric, per chloric, nitrous, nitric or chromic acids the method is inapplicable.
Victoria Yellow (LDC) Aniline Orange A mixture of the potassium salts of dinitro-*o*-cresol and dinitro-*p*-cresol No. 8	A reddish-yellow powder which sublimes when heated at 100°. The potassium salt deflagrates, but the ammonium salt burns quietly. H_2O: orange-yellow solution. HCl to aqueous solution: white precipitate of dinitrocresol. NaOH: unaltered. H_2SO_4: pale yellow solution, white precipitate on dilution. Light: 4–5. Dyes wool and silk orange. Too fugitive for use in dyeing, but was used formerly for colouring butter, macaroni, liqueurs, confectionery &c., until prohibited on account of its poisonous properties.	
Martius Yellow (Gy) (A) **Naphthol Yellow** **Golden Yellow** **(DH) (S) (SCI)** **Aniline Yellow (B)** **Ammonium or sodium salt of 2:4-dinitro-α-naphthol** **No. 9** (6)	Sodium salt, small yellowish-red needles; ammonium salt, small orange-yellow plates; calcium salt, yellowish-red crystals. The sodium salt deflagrates on heating, but the ammonium salt burns quietly. Partial absorption in blue and violet. H_2O: the sodium salt dissolves in 35 parts, and the calcium salt in 265 parts of water, with a yellow colour. The ammonium salt is also soluble in alcohol. The solutions are poisonous but not bitter. HCl to aqueous solution: yellow precipitate of dinitronaphthol (M. P. 138°), soluble in ether (distinction from No. 10). NaOH: unaltered. H_2SO_4: yellow solution, yellow precipitate on dilution. Dyes wool and silk, from an acetic acid bath, golden-yellow; fugitive to washing, milling, rubbing and ironing. Light: 4–5. Used for colouring soap, spirit varnishes, and to a limited extent for shading wool in dyeing unions by the single-bath process.	

Naphthol Yellow S, H S, O S, (H) (DH) (S) (SCI) (B) (By) (C) (GrE) (MIB) Acid Yellow (DH) (SCI) Citronine A (L, Potassium salt of 2: 4-dinitro-α-naphthol-7-sulphonic acid No. 10 (7)	A light yellow or orange-yellow powder which burns with yellow scintillations. The free acid crystallises from hydrochloric acid in fine needles. Partial absorption in blue and violet. H_2O: readily soluble with a yellow colour. HCl: no precipitate (distinction from No. 9). NaOH: unaltered. KOH: yellow flocculent precipitate. H_2SO_4: yellow solution, which brightens on dilution. Zinc dust and acetic acid: decolorised, but a salmon colour returns on air-oxidation. Light: 3–2. Dyes wool and silk yellow from an acid bath. Used largely for compound shades on wool and for colouring foodstuffs. Officially permitted for the latter purpose in the United States and Australia.

Naphthol Yellow is occasionally adulterated with *dextrin* and *sodium sulphate*, the proportion of the latter admixture sometimes reaching 50%. It is sometimes adulterated with *picric acid*, to detect which a sample should be dissolved in water, the cold solution acidified freely with hydrochloric acid, and the liquid filtered. If picric acid is present, the filtrate will have a marked yellow colour, and the acid can be obtained in crystals by evaporation.

Naphthol Yellow may be distinguished from picric acid by boiling wool in the acidified solution, washing it, heating it with cuprammonium sulphate, and again washing. When a fibre or fabric dyed with picric acid is boiled with the ammoniacal copper solution it turns bluish-green, but if Naphthol Yellow has been used an olive-green tint results.

When a material dyed with Naphthol Yellow is wrapped in white paper and heated to 120° in an air-bath, part of the yellow colour is transferred to the paper. Hot water or hot dilute ammonia dissolves the colouring matter, and the yellow solution is decolorised by hydrochloric acid, a yellow-white precipitate being produced (distinction from picric acid).

Naphthol Yellow has sometimes been employed for colouring butter, cheese, macaroni, mustard, saffron, etc., for which uses, however, its marked poisonous characters render it very unfit.[1] The detection of butter-colours will be described under "Annatto."

Martius' yellow, when used in foods taken into the stomach, may be detected in the urine by the following methods:

1. The urine slightly acidified with hydrochloric acid is shaken with ether. A portion of the ethereal layer is shaken with potassium hydroxide solution. The alkaline liquid is acidified with hydrochloric acid and warmed with some strands of white wool free from fat, and mordanted with alum. The wool is coloured yellow in the presence of as little as 0.000001 grm. of the dyestuff.

2. A portion of the ethereal solution is evaporated to dryness, and a drop of potassium cyanide solution is added to the residue, when a red coloration is obtained.

3. Another portion of the residue left on evaporation of the ethereal solution is mixed with potassium bisulphate, heated to redness in a glass tube, and the residue dissolved in water. A paper moistened with Griess's reagent and placed in the solution is coloured violet.

4. A solution of Martius' yellow, or urine containing it, gives with cobalt chloride and a little sodium hydroxide, a fine green pigment.

5. With stannous chloride and a trace of ammonia, Martius' yellow gives a white precipitate, which becomes rose-red on subsequent treatment with ammonia.

For the recognition of Martius' yellow in the stomach, intestines, etc., the material is finely cut up, acidified slightly with hydrochloric acid, and digested for some hours at 40°–50° with absolute alcohol. The liquid is filtered, evaporated at a low temperature, made alkaline with potassium hydroxide, filtered, acidified with hydrochloric acid, and shaken with ether, and the extract is then examined as above.

[1] Comparatively small doses of Naphthol Yellow are said to cause asthmatic breathing, a considerable rise of temperature (without convulsions), and ultimately death (Cazeneuve and Lepine, *Compt. rend.*, 1885, 1167). According to Weyl (*Ber.*, 1888, **21**, 2191), Martius' yellow is well tolerated by rabbits, but small doses proved fatal to dogs. A dog weighing 6850 grm., to which a dose of 0.5 grm. of dinitronaphthol was given on 2 successive days, and 1 grm. of the sodium salt on the third day, died on the fourth day. Less than 1 grm. given subcutaneously caused the death of a similar dog. On the other hand, Naphthol Yellow S proved innocuous to dogs in 4 times these amounts.

2:4-NITRONAPHTHOL-SULPHONIC ACID

Amido Yellow E (MLB) Dinitrophenylamino-methyl-diphenyl-amine sulphonic acid No. 11	A dark brown crystalline powder. H_2O: orange-brown solution. HCl: separation of oily drops which coagulate to a brown crystalline precipitate. NaOH: brown flocculent precipitate. H_2SO_4: yellow solution, greenish-yellow solution, and then yellowish-brown precipitate on dilution. Light: 3–2 Dyes wool from an acid bath level brownish-yellow. It is the fastest to light of any yellow acid dye at present on the market, but, although the colour is not destroyed by alkalies, it bleeds badly when subjected to treament with alkalies.	
Aurantia (GrE), (A) Ammonium salt of hexanitro-diphenylamine or dipicrylamine No. 12	Reddish-brown crystals, which burn with deflagration. H_2O: orange-yellow solution. HCl: bright yellow precipitate of hexanitrodiphenylamine; yellow prisms, M. P., 230°, with decomp. Dyes wool and silk orange from an acid bath and yields a fine orange on leather, but its use was abandoned owing to its poisonous properties. Light: 4–5 Used as explosive and as a light filter in photography.	
Pigment Chlorine GG pdr. and paste [MIB] 1:1′-Dinitro-4:4′ dichlorodiphenyl-2:2′-di-iminomethane No. 13 (8)	A bright yellow powder or paste. Crystallises from glacial acetic acid or alcohol in yellow leaflets, M. P. 224°. H_2O: insoluble. Alcohol: yellow solution hot. HCl to alcoholic solution: almost colourless solution. NaOH: unaltered. H_2SO_4: almost colourless solution, unaltered on dilution. Used for colour-lakes of a pure greenish-yellow shade, very fast to water, and practically fast to spirit, oil, and lime. The lakes darken on exposure to light, and the fastness to sublimation is moderate.	
Lithol Fast Yellow GG. (B) 1:1′-Dinitro-5:5′-dichlorodiphenyl-2:2′-di-iminomethane No. 14	A bright yellow paste, somewhat redder than No. 13. Crystallises from glacial acetic acid in golden yellow needles, M. P. 266°. H_2O: insoluble. Alcohol: slightly soluble with a yellow colour on boiling. HCl to alcoholic solution: yellow solution. NaOH: unaltered. H_2SO_4: brown solution,	Not used at all. Used only during the great war. Not stable. Important pigment.

	yellowish-brown precipitate on dilution. Used for the manufacture of colour lakes, for lithographic printing, for coloured discharges in calico printing, and as a non-poisonous substitute for chrome-yellow in the manufacture of wall-papers and distemper colours. The fastness to light is excellent, but the resistance to heat is poor.	

II. AZO COLORING MATTERS

No. 15–229

a. Mono-azo-dyes

$$R - N = N - R_1$$

Azo colouring matters are prepared on a commercial scale by different methods, but the most important one is the so-called "coupling-reaction" of diazo compounds with amines or naphthols. The diazo compounds are made by diazotising amines or their derivatives, such as sulphonic acids, oxy-derivatives etc. On treating primary amines of the aromatic series with a mineral acid, such as hydrochloric or sulphuric acid, and free nitrous acid (sodium nitrite is practically always used and an excess of the mineral acid) there is formed a *diazonium salt.* This salt undergoes interesting changes either in acid or in alkaline solution, according to the character of the amine. Whilst the diazonium salt behaves like an ammonium salt, its products of re-arrangement have the property of combining with many naphthols or amines, forming first addition-products which re-arrange themselves according to the conditions. Three reactions may take place.

1. The diazo compound formed from the diazonium salt forms first the addition-compound.

a. The diazo group is transported to the amine, and the original amine which has been diazotised is regenerated.

b. There is formed an ester of the diazo compound, either an oxygen ester (diazo ester) or a diazo-amino compound.

c. The addition compound is transformed at once into an azo compound.

Formulae:

$$\text{I. } R - NH_2(HCl) + NaNO_2 + HCl =$$

$$R - N_2 - Cl + 2H_2O + NaCl$$

Diazonium salt of the constitution

$$R - \overset{\overset{\displaystyle N}{|||}}{N} - Cl$$

$$\text{II. } R - \overset{\overset{\displaystyle N}{|||}}{N} - Cl \overset{+H_2O}{\rightleftarrows} R - N = N - OH + HCl$$

Diazonium compound — Diazo compound, coupling with Amines and Phenols.

$$\text{III. } \underset{\text{Diazo compound}}{R - N = N - OH} + \underset{\substack{\text{Phenol} \\ \uparrow \\ \text{or} \\ \uparrow \\ \text{Amine} \\ R'' - NH_2}}{R' - OH} = \underset{\substack{\text{Additional compound} \\ \text{can be isolated in} \\ \text{certain cases.}}}{\left\{\begin{array}{l} R - N = N - OH \\ R' - OH \\ ((R'' - NH_2)) \end{array}\right\}}$$

$$\text{Addition compound} \begin{cases} \xrightarrow[\text{a}]{\text{in presence of HCl}} R - NH_2 + R'' - N_2 - Cl \\ \xrightarrow{\text{b}} R - N = N - NH - R'' \text{ or } (R - N_2N - O - R') \text{ Diazo-amino compound.} \\ \xrightarrow{\text{c}} R - N = N - R'' - NH_2 \text{ Azo compound} + HCl \text{ resp. } H_2O \end{cases}$$

The facts, as outlined above, have only been known for a comparatively short time, but seem to afford the best explanation of the reactions. The task of the technical chemist is to try and find out the best possible conditions for the manufacture of the azo compound, and it is well known that in many cases where the diazo-amino compound is formed (or the oxy-ester) no satisfactory product is obtained. The old view that a diazo-amino compound is first formed must be definitely abandoned. It is true that in certain cases these compounds are actually observed, but, as a rule, we can take it as a certainty that no such derivatives are formed.

The diazo compound which has the faculty of coupling with amines or phenols undergoes another change when it is treated with caustic alkalies, preferably at temperatures of 50–80°. It is then transformed into an isomeride which forms very stable alkali salts, and which is not explosive in the dry state, as are the diazonium salt or the normal diazotates. The constitution of this stable iso-diazotate is not established beyond doubt. Hantzsch believes it to be a stereo-isomeride, whilst Bamberger thinks that it has a different constitution:

$$\underset{\text{normal-diazo compound "syn."}}{R - N = N - O - H} \rightarrow \underset{\text{"anti."}}{R - N = \underset{\substack{| \\ OH}}{N}}$$

Hantzsch.

$$R - N = N - OH \rightarrow R - \underset{\substack{| \\ H}}{N} - NO$$

Nitroso-amine

Bamberger

This interesting question is not settled, and more work has to be done to solve the problem. The stable anti-compounds, or nitrosoamines *are transformed immediately into diazonium salts when they are treated with mineral acid.* For this reason they are commercial products and are sold under many names, such as *Nitrazole* or "rapid developer." They are used to a large extent in the production of developed azo dyes on the fibre and have replaced the amines to a great extent, because it is no longer necessary to diazotise in the dye works with acid and nitrite in the presence of ice—an operation which is not always easy.

GROUPS OF AZO DYES

We distinguish several Groups of Azo dyes according to the number of azo groups which are in a given molecule.

Mono-azo Dyes.—These are arranged according to the radicles which are in the substance. Thus we have:

Benzene-azo-benzene dyestuffs.

Benzene-azo-naphthalene dyestuffs.

Naphthalene-azo-naphthalene dyestuffs.

Disazo Dyes.—There are distinguished two kinds of Disazo colouring matters.

a. Those which are formed by the action of two diazo compounds on one single amine or naphthol are called *Primary disazo dyestuffs.* They are generally represented in the following manner:

$$R \rightarrow A \leftarrow R'$$

or

$$R — N_2 \rightarrow A \leftarrow N_2 — R'$$

b. *Secondary disazo dyestuffs.*

These are formed by treating an azo dyestuff containing a free amino group with strong mineral acid and nitrous acid, and coupling the diazo compound thus obtained with an amine or a phenol. These disazo dyestuffs are represented for practical use in this manner:

$$R \rightarrow R' \rightarrow R''$$

or

$$R - N_2 \rightarrow R' - N_2 \rightarrow R''$$

c. *Disazo colouring matters derived from a diamine, such as benzidine, o-tolidine, o-dianisidine, p-phenylenediamine, etc., etc.*

This group is very important, because many of its members have the property of dyeing cotton without mordant. They have changed the whole method of dyeing. The first dye of this class was Congo red. We represent these dyestuffs, as a rule, as follows:

$$\begin{array}{c} R \\ \nearrow \\ D \\ \searrow \\ R' \end{array}$$

R and R′ may or may not be identical. We have *simple* or *mixed* dyestuffs of the para-diamine type.

Trisazo colouring matters.

These are very numerous, and may be divided into several classes. We can distinguish *Primary trisazo colouring matters:*

$$\begin{array}{ccc} & R' & \\ & \downarrow{\scriptstyle N_2} & \\ R \xrightarrow{N_2} & A & \xleftarrow{N_2} R'' \end{array}$$

Secondary trisazo colouring matters:

$$R \xrightarrow{N_2} R' \xrightarrow{N_2} R'' \xrightarrow{N_2} R'''$$

Mixed trisazo compounds:

$$R \xrightarrow{N_2} R' \xleftarrow{N_2} R'' \xrightarrow{N_2} R'''$$

or

$$R \xrightarrow{N_2} R' \xrightarrow{N_2} R'' \xleftarrow{N_2} R'''$$

etc.

Many proposals have been made for naming these very varied trisazo dyes but, in the reviser's opinion, it is best to differentiate them as above, because this is the simplest and quickest means of finding out what kind of substance is present.

Trisazo dyestuffs derived from *p*-diamines may be represented in exactly the same manner. Thus, Diamine green B, for instance, may be represented as follows:

$$\begin{tikzcd} & A & R \arrow[l] \\ D \arrow[ur] \arrow[dr] & & \\ & R' & \end{tikzcd}$$

where D = Benzidine
A = H-acid (Amido naphthol-di-sulphonic acid (1. 8. 3. 6)
R = *p*-nitraniline (diazotised)
R′ = Phenol.

Other azo colouring matters are also known, such as derivatives of carbamide (urea), but they can all be arranged in the class of mono-, dis-, tris- or tetrazo-colouring matters. It is not possible, for want of space, to go into detail. For those interested in the chemistry of these dyes as distinct from their analysis, *Knecht's* Manual is recommended or *Georgievics'* book on organic dyestuffs, where all the details will be found.

AZO-COLOURING MATTERS. MONO-AZO-DYES

Spirit Yellow (LK) Aniline Yellow (DHC) Aminoazobenzene (A) (BDC) Aminoazobenzene hydrochloride No. 15 (31)	The hydrochloride forms steel-blue crystals which are probably the quinonoid form, or a flesh-coloured product which is probably the benzenoid form; the free base is a brownish-yellow product, M. P. 127.5°. Partial absorption in water in blue and violet. Addition of acid $\eta = 519$ and $\eta = 489.8$. H_2O: very sparingly soluble, with a yellow colour; partially decomposed on boiling, with precipitation of the base. Alcohol: more soluble than in water. HCl: red solution which decomposes on prolonged boiling. Zinc dust: aniline and *p*-phenylene-diamine. H_2SO_4: brown solution, red solution on dilution, HNO_3: decomposition. Used for colouring spirit varnishes, fats, cheese &c., as it is not poisonous. Also in the manufacture of its mono- and disulphonic acids, disazo dyes, *p*-phenylenediamine, and Indulines.	The most important "fat-yellow." Used for dyeing acetate-silk under the name of **Azonine G.** can be developed with p-naphthol or Naphthol AS. Very fast red. The ω-methyl-sulphonic acids are the corresponding **Ionamines** of Arthur Green.

Fast Yellow G, S, O S R. (B) (By) (DH) (K) (tM) (SCI) Acid Yellow R, S, SF, GR, (A), (GrE), (S) (L) (BDC) Chrysoline (Gy) Sodium salt of aminoazobenzene disulphonic acid No. 16 (137)	A yellow powder. Absorption in water, after addition of acid, η = 490. H_2O: yellow solution. HCl: aminoazobenzene monosulphonic acid is precipitated as a flesh-coloured precipitate, and the solution becomes orange. Aminoazobenzene-disulphonic acid: reddish needles with a violet lustre, dissolves with an orange colour. NaOH: unaltered. H_2SO_4: brownish-yellow solution; yellowish-orange solution on dilution. HNO_3: red solution with decomposition. Reduction: sulphanilic acid and *p*-phenylenediamine sulphonic acid. Light: 1–2. Dyes wool and silk yellow from an acid bath. Level-dyeing 2; relation to cotton 3; relation to silk, 3. Used for compound shades, for dyeing hats, carpet yarns, colouring food-stuffs, and for the manufacture of disazo dyes.	One of the most important yellow wool-dyes.
Amidoazotoluol (B) (C) (BDC) Fast Oil Yellow (WSS) (SCI) (StCl) (GrE) Spirit Yellow R (K) Fat-orange L S (SCl) Aminoazotoluene hydrochloride No. 17 (68)	The base forms orange-yellow lumps and crystallises from alcohol in yellow plates, M. P. 100°. H_2O: practically insoluble. Alcohol: brown solution on heating. HCl to alcoholic solution: red crystals of the hydrochloride separate, which dissolve in hot alcohol. H_2SO_4: brown solution; reddish solution, and then a reddish precipitate of the sulphate on dilution. Light: 2–3. Used for colouring varnishes, fats, margarine, and wax yellow. Monoacetyl-derivative, brick-red powder, M. P. 185–186°.	Used like No. 16 under the name of **Azonine R. Ionamine R** = the ω-methyl-sulphonic acid. Intermediary for Biebrich-scarlets.
Fast Yellow RL, R, (B) (K) (A) Solid Yellow Y (B) Yellow W, (By) Lissamine Yellow T (B.DC) Sodium salt of amino-azotoluene disulphonic acid. No. 18 (149) Oil Yellow D, 412F, (NCW) (CD) (B.-D.C) Fast Oil Yellow B, (LBH) Benzene-azo-dimethyl-aniline No. 19 (32)	A yellow-brown powder. H_2O: yellow solution. HCl: magenta-red solution. NaOH: unaltered. H_2SO_4: yellow-brown solution; magenta-red solution on dilution, Light: 1–2. Dyes wool and silk reddish-yellow from an acid bath. Crystalline, yellow plates, M. P. 115°. H_2O: insoluble. Alcohol: yellow solution. HCl: red solution from which the hydrochloride crystallises in purple-red hair-like needles; the base separates as an orange-yellow precipitate on addition of sodium hydroxide. H_2SO_4: yellow solution, red solution on dilution. Light: 5. Used for colouring oils, fats, butter, margarine, spirit varnish &c.	Used to a fairly large extent for margarine.

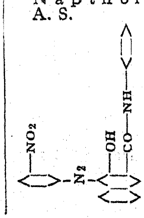
Chrysoidine Y pdr. (SCI) (StD) (A) (B) (C) (GrE) (K) (G) (Gy) (BDC) Y, J, A, R, 2G, yRP Chrysoidine Oil Colour Brown Salt R (MLB) for development. Benzene-azo-*m*-phenylene-diamine hydrochloride. No. 20 (33)	Red-brown crystalline powder or large dark brown shining crystals with a green lustre. The crystals contain the homologues from *o*- and *p*-toluidine. Partial absorption in blue and violet. H_2O: orange-brown solution. Alcohol: orange-brown solution. Ether: insoluble. HCl to aqueous solution: brown-yellow gelatinous precipitate which consists of hair-like needles. NaOH: red-brown precipitate of Chrysoidine base, M. P. 117°C., sparingly soluble in water, soluble in ether, alcohol, or benzene. H_2SO_4: brown-yellow solution; cherry-red to orange solution on dilution. Light: 4–5. Dyes wool and silk direct, and cotton mordanted with tannin and tartar emetic, orange. Used chiefly for cotton dyeing, less for wool and silk dyeing and printing. Also for leather, fats, jute &c. In calico printing Chrysoidine Y is used as a padded prepare and developed with diazotised *p*-nitroaniline for the production of fast dischargeable browns. The white is excellent with hydrosulphite.	Very important leather, cotton dye. Cheap.
Chrysoidine R, (tM) R pdr. RR cryst. (Gy) (SCI) (GrE) 3R, RE, RG, RL, (B) Cotton Orange Benzene-azo-*m*-toluylene diamine hydrochloride No. 21 (34)	Yellowish-brown lumps. H_2O: sparingly soluble, with a yellow colour. Alcohol: soluble, with a yellowish-red colour. HCl to aqueous solution: red solution. NaOH: yellow precipitate of the colour base, M. P. 165–166°. H_2SO_4: green-yellow solution, which soon turns bluish-red on the surface; bluish-red and then yellowish-red solution on dilution. Dyes cotton, mordanted with tannin and tartar emetic, orange. Light 4–5. Used in calico printing as a padded prepare, and developed with diazotised *p*-nitroaniline for the production of fast dischargeable browns.	
Aniline-Azo-Naphthylamine (HM) **Oil Yellow** AB (LDC) Benzene-azo-*β*-naphthylamine No. 22	Orange paste or powder which crystallises from alcohol in orange-red plates, M. P. 104°C. The minimum melting point permitted when used for colouring foodstuffs or drugs is 102°. H_2O: insoluble. Alcohol: orange-yellow solution. HCl to alcoholic solution: reddened. NaOH to alcoholic solution: unaltered. H_2SO_4: bluish-violet solution;	Very little used.

	red solution and orange precipitate on dilution. HNO_3: Decomposition. Light: 3. Used for colouring foodstuffs. Yellow AB and Yellow OB (No. 61) are yellow colouring matters officially permitted for colouring foodstuffs in the United States. Used as a constituent of boot polishes.	
Fat Orange 3A, (SCI) Sudan G, (AAP) (A) Oil Yellow (NBC) Benzene-azo-resorcinol No. 23 (35)	Brown-powder or red needles, M. P. 160° or 170°. Frequently contains disazo compounds. Partial absorption in water and alcohol, in blue and violet. H_2O: very slightly soluble, with a yellow colour. Alcohol or ether: readily soluble, with a yellow colour. HCl to aqueous solution: pale brown precipitate. NaOH: orange-brown solution. H_2SO_4: brownish-yellow solution; pale brown precipitate on dilution. HNO_3: decomposition. Light: 2–3. Used for colouring spirit varnishes, oils and fats, yellow.	
Fat Orange A. (SCI) Spirit Yellow I, E, (BDC) Sudan A, K Oil Orange LG, R Aniline Orange Insol. (StD). Benzene-azo-β-naphthol No. 24 (36)	A brick-red powder. H_2O: insoluble. Alcohol: orange-red solution; crystallises in glistening red-gold plates or needles, M. P. 134°. Concentrated HCl: red solution on warming, from which a hydrochloride crystallises in dark cantharides-green needles. The hydrochloride is very unstable and, when filtered, loses hydrochloric acid, forming the red benzene-azo-β-naphthol. NaOH: insoluble. H_2SO_4: magenta-red solution; orange-yellow precipitate on dilution. HNO_3: decomposition. Light: 3–2. Used for colouring oils, spirit, varnishes &c.	
Cochineal Scarlet G (Sch) Sodium salt of benzene-azo-α-naphthol-5-sulphonic acid No. 25	A brick-red powder which crystallises from water in red leaflets. H_2O: yellowish-red solution. Alcohol: very slightly soluble. HCl to aqueous solution: brownish-red precipitate. NaOH: orange-yellow colour. H_2SO_4: cherry-red solution, brownish-red precipitate on dilution. HNO_3: decomposition. Light: 3. Dyes wool from an acid bath brick-red, moderately fast to light, milling and acids. Hard water must be avoided, as the dye forms insoluble calcium and magnesium salts.	

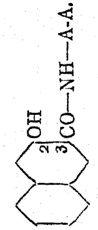
Croceine Orange B, Y conc., Y, NEN, (By) G (A) (C) (K) (By) (tM) (StD) Ponceau 4GB, (Lev) (A) Orange gR, X (B) Sodium salt of benzene-azo-β-naphthol-6-sulphonic acid No. 26 (37)	The sodium salt is a bright red powder, and the free acid crystallises in small red-brown needles with a greenish-golden lustre. Absorption in water (Crocein Orange B (A)λ = 515.8 and λ = 482.8. H_2C: orange-yellow solution. Alcohol: moderately soluble, with an orange colour. HCL to aqueous solution: yellow-brown precipitate. NaOH: brownish-yellow solution. H_2SO_4: orange-yellow solution; yellowish red precipitate on dilution. HNO_3: decomposition. Light:3. Dyes wool and silk orange from an acid bath, or wool from a neutral bath. Level-dyeing 2, relation to cotton 3–4; relation to silk 3–4. Used for dyeing wool, silk, unions, jute, etc., and for pigment manufacture.	
Orange GG, GR, GG cryst. G, (StD), (A) (B) (C) (GrE) (K) (MLB) (BDC) Acid Orange Gg, (Gy) Fast Light Orange G (By) Kiton Fast Orange G (SCI) Sodium salt of benzene-azo-β-naphthol-6:8-disulphonic acid No. 27 (38)	Yellowish-red powder or crystalline leaflets. Absorption in water, λ = 504.5 and λ = 474. H_2O: orange-yellow solution. Alcohol: readily soluble, with an orange colour. HCl to aqueous solution: unaltered. NaOH: yellowish-red solution. H_2SO_4: orange-yellow solution, unaltered on dilution. $CaCl_2$: crystalline calcium salt, readily soluble hot, sparingly soluble cold. HNO_3: decomposition. Light: 2. Dyes wool and silk orange-yellow from an acid bath. Level-dyeing 2. Used for dyeing wool, silk, and half-silk.	One of the most important orange dyes. Fairly fast to light.
Acid Orange *R, (AJ)* Orange R, H (BDC) Ponceau GL, 2G, (A) (B) (C) (MLB) Sodium salt of benzene-azo-β-naphthol-3:6-disulphonic acid No. 28 (39)	A bright red powder. H_2O: reddish-orange solution. Alcohol: slightly soluble with an orange coloration. HCl to aqueous solution: unaltered. NaOH: rather yellower. H_2SO_4: cherry-red solution; orange solution on dilution. Light: 2–3. Dyes wool and silk reddish-orange from acid bath. Level-dyeing 3; relation to cotton 2–3; relation to silk 3. Used for worsteds and yarns which are to be subjected to only mild soap or water milling, and for flannel and piece goods fast to stoving.	
Chromotrope N2R, 2R, (MLB) (StD) XL Carmoisine 6R	A brownish-red powder. Absorption in water: λ = 539.5 F(542.2) and λ = 501.6 F(503,2) A:548,0, 511,0	

(BDC) Biebrich Acid Red 4B, (K) Wool Red S3B (GrE) Sodium salt of benzene-azo - 1 : 8 - dihydroxy-naphthalene - 3 : 6- di-sulphonic acid No. 29 (40)	H_2O: magenta-red solution. Alcohol: difficultly soluble, with a bluish-red colour. HCl to aqueous solution: unaltered. NaOH: unaltered. H_2SO_4: ruby-red solution; yellowish-red solution on dilution. Light: 3. Dyes wool from an acid bath bluish-red, converted into pure blue to violet-black by after-chroming. Level-dyeing 2: relation to cotton 1; relation to silk 3. Used for compound shades on woollen yarn and piece goods.	
Fast Acid Fuchsin G, B (By) Fast Acid Magenta Azofuchsine (LDC) Sodium salt of benzene-azo -8-amino-1-naphthol- 3:6- disulphonic acid No. 30 (41)	A brown powder. Absorption in water: γ = 545.3 (F 542,5, 503,0) A: 546,5, 570,0 H_2O: magenta-red solution. Alcohol: soluble, with a magenta-red colour. HCl to aqueous solution: soluble, red precipitate. NaOH: orange-red solution. H_2SO_4: magenta-red solution; bright red solution on dilution. Light: 3. Zinc dust and acetic acid: decolorised, but a pink colour returns on air-oxidation. Dyes wool and silk moderately bright and level bluish-red from an acid bath. Fast to rubbing, stoving, and acids; good fastness to alkali; low fastness to light, and is converted into a dull violet on exposure.	
Amidonaphthol Red G, (MLB), Kiton Red G, Azogeramine B, S (BDC) Azophloxine GA, 2G, (By) Erio Floxine 2G, 2GI, (Gy) Acetyl Red J Brilliant Lanafuchsin 2G, (C) Brilliant Acid Carmine 2G, (GrE) Sodium salt of benzene-azo-8-	A red powder. H_2O: scarlet-red solution. W. 540,3, 502,0 A. 546,0, 508,5. Alcohol: difficultly soluble, with a bluish-red colour. HCl to aqueous solution: unaltered. NaOH: yellower. H_2SO_4: red solution, unaltered on dilution. Yellow-red Light: 1–2. Dyes wool red from an acid bath, unaltered by after chroming. Level-dyeing 2. Used for compound shades on woollen yarn and piece goods for wool and silk printing, and for lake manufacture with baryta.	**One of the most important level-dyeing colouring matters.** On reduction with Sn + HCl (see introduction) Amido-H-acid is obtained and not mono-acetyl-amido-H acid.

acetyl-amino-1-naphthol-3:6-disulphonic acid No. 31 (42)		
Brilliant Sulphon Red B, 5B, (S) Fast Sulphon Violet 5BS, (S) Sodium salt of R-azo-8-toluene-*p*-sulphon-amino-1-naphthol-3:6-disulphonic acid. No. 32 (182)	Maroon powder. W. 542,5, 504,2 A. 547,0, 509,5. H_2O: very soluble with a bluish-red colour. Alcohol: bluish-red solution. HCl to aqueous solution-unaltered. NaOH: brownish-red solution. H_2SO_4: orange-red solution, red precipitate on dilution. Light: 4. Dyes: wool and silk from a faintly acid bath red, fast to light, acids, alkalies, milling and stoving. *Fast Sulphon Violet* 5BS: 4*R* L: W. 581,0, 538,0 4*R* L: A. 587,5, 543,5	
Brilliant Sulphon Red B	Brown powder. Absorption in water $\lambda = 583.2$ and 539.0. H_2O: very soluble, with a violet colour. Alcohol: violet-blue solution. HCl to aqueous solution: brick-red solution. NaOH: brownish-red solution. H_2SO_4: red solution; yellower solution dilution. HNO_3: orange. Dyes: wool and silk level bluish-violet from a faintly acid bath.	
Tolane Red B and G (K) Sodium salt of benzene-azo-8-amino-1-naphthol-3:6-disulphonic acid No. 33 (43)	A brown powder. H_2O: magenta-red solution. Alcohol: insoluble. HCl to aqueous solution: yellowish-brown solution or precipitate. NaOH: orange-red solution. H_2SO_4: magenta-red solution; yellow-brown solution on dilution. Light: 4. Dyes wool and silk brilliant red, with a bluish tone, from an acid bath.	
Azo Orseille R (A) Sodium salt of benzene-azo-7-amino-l-naphthol-3:6-disulphonic acid No. 34 (44)	A red-brown powder. H_2O: yellowish-red solution. W: 537,0 A: 540,0 Alcohol: soluble, with a yellowish-red coloration. HCl to aqueous solution: yellowish-brown precipitate. NaOH: yellower solution. H_2SO_4: yellowish-red solution; orange-yellow precipitate on dilution. HNO_3.: red. Light: 4. Dyes: wool level archil-red from an acid bath. Discharged by stannous chloride.	Scarcely used to-day.
Brilliant Lake Red R, R paste (MLB) Benzene-azo-β-naph-	Bright red paste. It crystallises from glacial acetic acid in reddish-brown needles, M. P. 232°.	

thol carboxylic acid. No. 35 (45)	W: insoluble. A: λ 504.0, 547.5. Used for the manufacture of lakes which possess similar fastness to light to the Ponceau Lakes, and good fastness to water and spirit, but are not fast to oil. The dry lakes are very bright, and that prepared from calcium acetate is particularly beautiful.	
Alizarine Yellow G paste, GG, 2G, 3G, SGW, (SCI) (M L B) (L e v) (By) (S) GGW, (T) (MLB) Eriochrome Yellow 2G, 2GI, (Gy) Anthracene Yellow GG (C) Metrachrome Yellow RA (A) Khaki-Yellow WN (BDC) *m*-Nitrobenzene-azo-salicylic acid No. 36 (48)	Alizarine Yellow GG (the free acid) is a yellow 20% paste, soluble in alcohol, very slightly soluble in water, whilst Alizarine Yellow GGW (the sodium salt) is a yellow powder soluble in water, with a yellow colour. In alcohol partial absorption in blue and violet. Alcohol: yellow solution. HCl: orange-yellow precipitate. NaOH: orange-yellow solution. H_2SO_4: orange solution; bright yellow precipitate on dilution. HNO_3 on dyed material: yellow spot with a scarlet rim. Dyes: chrome-mordanted wool from an acid bath, or wool from a single bath with Metachrome mordant, or wool from an acid bath and after-chromed yellow. The shade on an aluminium mordant is too loose to soap to be of use. Level-dyeing 1-2; relation to cotton 2–3; relation to silk 2–3. Used as a substitute for fustic in dyeing and for Persian berries in calico printing. Discharged white by hydrosulphite or chlorate.	For wool the *o*-Cresotinic acid is used, being 30% stronger. Very important for printing. Also callde Nietzkis-yellow.
Prague Alizarine Yellow G (Ki) Sodium salt of *m*-nitrobenzene-azo-β-resorcylic acid. No. 37 (49)	Yellow powder. H_2O: yellow solution. Alcohol: yellow solution. HCl to aqueous solution: yellow precipitate. NaOH: orange-yellow solution. H_2SO_4: yellow solution; yellow precipitate on dilution. HNO_3: red. Dyes: chrome-mordanted cotton pure yellow, and chrome-mordanted wool brownish-yellow. Used also for calico printing with chromium acetate.	No longer in use.
On the Fibre—*m*-Nitroaniline Orange (MLB) The Amine- Fast Orange R Base (GrE) Azophor Orange (MLB) *m*-Nitrobenzene-azo-β-naphthol No. 38 (46)	*m*-Nitroaniline Orange in substance, crystallises from toluene in orange plates, M. P. 193–194°. H_2O: insoluble. NaOH: insoluble, H_2SO_4: magenta-red solution, Spectrum in conc. H_2SO_4 $\lambda = 557.6$ and $\lambda = 524.1$. HNO_3: red. Dyes cotton padded with β-naphthol and developed with the diazotised base orange. Used particularly in calico printing.	Important, especially with Napthol A. S. 

	The orange obtained with β-naphthol or naphthol AS is discharged well by hydrosulphite. In the case of β-naphthol the orange is not very resistant to oxidation discharges, but that from naphthol AS is much more resistant.	
Orange III, 3, (St.D.) Sodium salt of *m*-nitrobenzene-azo-β-naphthol-3:6-disulphonic acid. No. 39 (47)	A reddish-brown powder. H_2O: reddish-yellow solution. HCl: orange-yellow precipitate, soluble in an excess of water. NaOH: yellowish-brown solution. H_2SO_4: orange yellow solution, orange-yellow precipitate, and then a yellow solution on dilution. Light: 3–4. Dyes wool and silk orange from an acid bath.	
Alizarine Yellow RW, R, RO, (BDC) (SCI) (By) (MLB) Metachrome Orange paste R, (A) Alizarine Orange R (S) (By) (MLB) Terracotta R pdr. (Gy) Orange R (S) Anthracene Yellow RN, (C) Alizarine Orange M (BDC) *p*-Nitrobenzene-azo-salicylic acid. No. 40 (58)	Alizarine Yellow R (free acid) is a 20% paste insoluble in water, soluble in alcohol, with a reddish-yellow colour, and may be crystallised. M. P. 257°. Alizarine Yellow RW (the sodium salt) is a brownish-yellow powder. H_2O: brownish-yellow solution. HCl: brownish-yellow precipitate. NaOH: blood red solution. H_2SO_4: orange-yellow solution; brown-yellow precipitate on dilution. HNO_3 on dyed material: yellow spot with a scarlet rim. Dyes wool brownish-orange on a chromium mordant. Level-dyeing 2–1; relation to cotton 3–4; relation to silk 3. Light: 2. Dyes cotton brownish-orange on a chromium mordant. Used in calico printing with a chromium mordant. A fast orange is obtained with a strong printing paste, but the shade rapidly becomes yellower as the strength is reduced. Discharged white by hydrosulphite or chlorate.	
Prague Alizarine Yellow R (Ki) Sodium salt of *p*-nitrobenzene-azo-β-resorcylic acid. No. 41	An orange-yellow powder. H_2O: orange-yellow solution. Alcohol: orange-yellow solution. HCl to aqueous solution: orange-yellow precipitate. NaOH: bluish-violet solution. H_2SO_4: orange-yellow solution, orange-yellow precipitate on dilution. Light: 2–3. Dyes wool and cotton orange-yellow on a chromium mordant.	Not used.
Azo Cardinal G (A)	A brick-red powder. H_2O: reddish-yellow solution.	

p-Nitrobenzene-azo-ethylbenzylaniline sulphonic acid. No. 42 (50)	Mixture of a yellow and red dyestuffs. Alcohol: reddish-yellow solution. HCl to aqueous solution: red metallic glistening precipitate. NaOH: brick-red precipitate. H_2SO_4: yellow solution, red solution, and then red precipitate on dilution. Light: 2–3. Dyes wool cardinal-red from an acid bath. Fast to light, alkalies and acids, moderately fast to washing. Discharged by stannous chloride.	
Thiazol Yellow R (By) Sodium salt of *p*-nitrobenzene-diazo-amino-sulpho-benz-amino-thiocresol. No. 43 (51)	A brown powder. H_2O: difficultly soluble, with a reddish-yellow colour. Alcohol: insoluble. HCl to aqueous solution: yellow precipitate. NaOH: dark violet precipitate or solution. H_2SO_4: gold-yellow solution; yellow precipitate on dilution. Dyes cotton direct greenish-yellow; not fast to alkalies, acids or light. Light: 4–5. A satisfactory white discharge cannot be obtained in calico printing by the use of hydrosulphite or stannous chloride.	
On the Fibre Para Red (B) (MLB) Paranitraniline Red (MLB) *In Substance-* Pigment Red B, G, (MLB) Autol Red BL, BGL, paste (B) Fast Lake Red R (MLB) *The Amine* Paranitraniline S (By) Fast Red GG Base (GrE) *Stabilised diazotised p-Nitroaniline* Nitrosamine Red (B) Paranil A (A) Benzo Nitrol (By) Nitrazol C (C) Azophor Red PN (MLB)	*On the fibre:* brilliant scarlet-red fast to washing, chlorine, and light. Discharged by rongalite, hydrosulphite NF, and hydraldite A. In sulphuric acid: $\lambda = 578.2$ and $\lambda = 541.2$. H_2O: practically insoluble on boiling. Benzene: orange extract on boiling. Alcohol: orange-yellow extract on boiling. HCl: unaltered. NaOH: violet and red extract on boiling with a normal solution, the pattern becoming paler and duller. H_2SO_4: the pattern is coloured violet, and the violet solution changes to yellowish-orange on dilution. Red vapours are evolved on heating the pattern in a dry tube. Light: 1–2. *In substance:* red powder. Crystallises from acetic acid or toluene in orange-brown plates or needles, M. P. 249°. Insoluble in aqueous alkalies, soluble in alcoholic sodium hydroxide, with a violet colour. H_2SO_4: magenta solution; orange solution, and then red precipitate on dilution. Used as a substitute for vermilion in indigo discharge printing and for the manufacture of lakes with barium sulphate, fast to water and light, and moderately fast to lime.	Very important. Now: **Naphthol A. S. A. N.** *p*-Nitraniline or o-Nitraniline or *m*-Nitrotoluidine coupled with  A = Phenyl, Naphthyl, o-Anisyl (not fast) etc. etc. Naphthol A. S. are as fast as Alizarine except to boiling under pressure.

p-Nitrobenzene-azo-β-naphthol. No. 44 (56)		
Chromotrope 2B (MLB) Sodium salt of *p*-nitro-benzene-azo-1:8-di-hydroxy-naphthal-ene-3:6-disulphonic acid. No. 45 (57)	A reddish-brown-powder. In water: λ = 529.5 and λ = 504.8 F: W504,5, 541,5, A: 509,01 546,0 H_2O: yellowish-red solution. Alcohol: insoluble. HCl to aqueous solution: yellower. NaOH: bluish-red solution. H_2SO_4: dark violet solution; yellowish-red solution on dilution. Dyes wool from an acid bath bluish-red, converted into blue or black by after-chroming. Fast to acids, stoving, and rubbing; moderately fast to alkalies, but not fast to milling. Light: 3–4. Level-dyeing 2.	
Archil Substitute (H) (StD) Naphthion Red *p*-Nitrobenzene-azo-α-naphthylamine-4-sulphonic acid. No. 46 (52)	Brown paste. H_2O: reddish-brown solution. HCl: brownish-red precipitate. NaOH: brownish-red precipitate, soluble in water. H_2SO_4: magenta-red solution; brownish-red precipitate on dilution. Dyes wool archil-red from an acid bath. Moderately fast to light, acids, and alkalies, but less fast to milling. Light: 3. Used for compound shades.	No longer used very much. Formerly very important.
Archil Substitute V (A) 3VN, (StD) Sodium salt of *p*-nitro-benzene-azo-α-naph-thylamine-5-sulphonic acid. No. 47 (53)	Dark brown powder. H_2O: red solution. Alcohol slightly soluble. HCl to aqueous solution; bluish-colour or precipitate. NaOH: brownish colour. H_2SO_4: red solution. Dyes wool archil-red from an acid bath. Moderately fast to light and stoving. Light 3–4.	
Apollo Red B, G, (Gy) Archil Substitute extra, N pdr. (C) Sodium salt of *p*-nitro-benzene-azo-α-naph-thylamine-4:6 and 4:7-disulphonic acid. No. 48 (54)	Brown powder or paste. In water: λ = 494. F: partial absorption. H_2O: brownish-red solution. HCl: magenta-red colour. NaOH: brown precipitate, soluble in water. H_2SO_4: magenta-red solution, unaltered on dilution. Dyes wool level archil-red from an acid bath. Moderately fast to weather and stoving. Light 3–4.	Scarcely used.
Brilliant Archil C (C) Brilliant Wool Scarlet	A brown-red powder. W: 548,5, 512,0 A: insoluble. H_2O: magenta-red solution.	

(K) Sodium salt of the azimide of *p*-nitrobenzene-azo-1:8-naphthylene-diamine-3:6-disulphonic acid. No. 49 (55)	HCl: bluish-red solution. NaOH: blue solution. H_2SO_4: blue solution; violet-red solution on dilution. Dyes wool and silk very level bright bluish-red from an acid bath. Moderately fast to light and washing, and good fastness to acids, alkalies and stoving. Light: 3–4.	Very little used.
Wool Violet S (B) Sodium salt of 2:4-dinitrobenzene-azo-dimethylaniline-*m*-sulphonic acid. No. 50 (59)	Black powder or glistening green needles. In water: $\lambda = 555.8$. F: no distinct absorption. H_2O: reddish-violet solution. Alcohol: reddish-violet solution. HCl to aqueous solution: orange-red solution. NaOH: bluish-violet precipitate. H_2SO_4: scarlet-red solution; orange-red solution on dilution. Dyes wool level reddish-violet from an acid bath. Very sensitive to acids. Light: 4.	Scarcely used.
Azophosphine GO (MLB) Chloride of *m*-trimethylamino-benzene-azo-resorcinol. No. 51 (60)	Brown-powder or small reddish-yellow crystals. In water and alcohol: partial absorption in blue and violet. H_2O: yellowish-red solution. Alcohol: difficultly soluble. HCl to aqueous solution: orange-red solution. NaOH: orange-red solution. H_2SO_4: brownish-red solution, orange-yellow solution on dilution. Dyes cotton mordanted with tannin and tartar emetic yellow. Light: 4. Used for dyeing unions, as it has a direct affinity for unmordanted cotton from an acid bath, and for tinting cream shades.	
Azo Alizarine Yellow GP, (DH) Monochrome Yellow 3GN (LBH) Erio Chrome Yellow 4G Sodium salt of *p*-acetyl-amino-benzene-azo-salicylic acid. No. 52	Brownish-yellow powder (sodium salt). The free acid forms a yellow crystalline powder, M. P. 277°, from acetic acid. H_2O: orange-yellow solution. Alcohol: yellow solution. HCl to aqueous solution: brown precipitate. NaOH: orange solution. H_2SO_4: yellowish-brown solution, brown precipitate on dilution. Dyes chrome-mordanted wool yellow from an acid bath. Light: 2 Grey-green powder.	
Victoria Violet 4BS, S4B, (S) (A) (MLB) (GrE) Azid Violet 4BS, (DH) Erio Violet B, (Gy)	In water $\lambda = 579.5$ and $\lambda = 536.5$. F: W: 580,0 542,0 A: 582,0. H_2O: dark-violet solution. Alcohol: difficultly soluble, with a bluish-violet colour. HCl to aqueous solution: yellowish-red solution.	Very important.

Ethyl Acid Violet S4B, (B)
Fast Sulfon violet 5BS′ (M)
Azo Wool Blue (C)
Coomassie Violet AV (BDC)
Sodium salt of *p*-amino-benzene-azo-1:8-dihydroxynaphthalene-3:6-disulphonic acid.
No. 53 (61)

NaOH: reddish-yellow solution. H_2SO_4: bluish-red solution; yellowish-red precipitate soluble in water on dilution. Zinc dust and acetic acid: decolorised, but the colour returns partly on air oxidation.
Dyes wool bluish-violet from an acid bath.
Level-dyeing 3–2; relation to cotton 1; relation to silk 2.
The shade is reddened by exposure to light. Light: 3.

Kiton Red S (SCI)
Eriorubine G (Gy)
Azo Acid Red L (S) B, (MLB)
Lanafuchsine 6B, SB, SG, (C)
Sorbine Red (B) BB, G, (B)
Azogrenadine S, (By)
Azo Crimson S (By)
Sodium Salt of *p*-acetyl-amino-benzene-azo-*α*-naphthol-3:6-disulphonic acid.
No. 54 (64)

Red-brown powder.
Sorbine not B: F: W: η: 502.0|542,0. λ: A: 504,5|544,5.
Lanafuchsine: F: W: 519,5|561,0 A; 571,0|529,8.
H_2O: magenta-red solution.
HCl: scarcely altered. NaOH: yellower. H_2SO_4: red solution, scarcely altered on dilution. HNO_3: yellowish-red.
Dyes wool red from an acid bath. It is sensitive to copper.
Level-dyeing 2; relation to cotton 2; relation to silk: 2. Light: 2.
Used in dyeing compound shades on wool.
Discharged well by hydrosulphite.

One of the best red wool dyes.

Azo Crimson L, (By)
Azo-grenadine L, (By)
Azocoralline (WDC)
Sodium salt of *p*-acetylamino-benzene-azo-*β*-naphthol-3:6-disulphonic acid.
No 55 (65)

A cinnamon-brown powder which may be crystallised in glistening golden-yellow plates.
F: W: 599,5|547,5? A: insoluble.
H_2O: orange-red solution.
HCl: scarcely altered. NaOH: yellower. H_2SO_4: yellowish-red solution; orange-red solution on dilution.
HNO_3: yellowish-red.
Dyes wool moderately level brownish-red from an acid bath.

Chromotrope 6B (MLB)
Fast Acid Red EBB, (L)
Sodium salt of *p*-acetyl-aminobenzene-azo-1:8-dihydroxy-naphthalene-3:6-disulphonic acid.
No 56 (67)

Greyish-brown powder.
In water $\lambda = 5602$. and $\lambda = 520.7$.
F: W: 521,8|561,5 A: 570,0|530,0.
H_2O: violet-red solution.
Alcohol: difficultly soluble, with a violet colour. HCl to aqueous solution: unaltered. NaOH: yellower. H_2SO_4: ruby-red solution; bluish-red precipitate on dilution.
Dyes wool from an acid bath violet-red, converted into greenish-black by after-chroming. Light: 3.
Level-dyeing 2–3; relation to cotton 1–2; relation to silk 3.

Mostly used without chrome.

Amidonaphthol Red 6B, (MLB) Lissamine Red 6B (BDC) Kiton Red 6B, (SCI) Erio Phloxine 6BI, 6B, (Gy) Brilliant Acid Carmine 6B, (GrE) Sodium salt of *p*-acetyl-amino-benzene-azo-8-acetylamino-1-naphthol-3:6-disulphonic acid. No. 57 (66)	Violet-brown powder. F: Brillant and Carmine W: 518,0|561,5 A: 570,0|529,0. F: Amidonaphthol red: Mixture of yellow and yellow-red. H_2O: red solution. HCl: unaltered. NaOH: yellower. H_2SO_4: red solution, unaltered on dilution. Dyes wool red from an acid bath. Level-dyeing 2; relation to cotton 1; relation to silk 2–3. Light: 1–2. Used particularly for shading and also for dyeing wool full crimson shades.	Has replaced the chromothrope to a large extent.
Azogallëine (Gy) Hydrochloride of *p*-dimethylamino-benzene-azo-pyrogallol. No. 58 (62)	A black-brown powder. H_2O: difficultly soluble, with a greyish-yellow colour. Alcohol: yellow solution. HCl to alcoholic solution: greyish-yellow solution. NaOH: reddish-brown solution. H_2SO_4: dark yellow solution; yellow solution on dilution. Dyes chrome-mordanted wool and cotton dark violet. Light: 4.	Not on the market.
Azo Acid Blue B, 4B, 6B, B, 3B, (S), (By) (MLB) Erio Azurine B, (Gy) Ethyl Acid Blue RR, (B) Sodium salt of *p*-dimethylamino-benzene-azo-1:8-dihydroxy-naphthalene-4-sulphonic acid. No. 59 (63)	Azo Acid Blue 3BO, violet-brown powder. Azo Acid Blue 4B, greyish-black powder. Azo Acid Blue B|F: W: 584,0|538,0 A: 503,0|541,0 Azo and Blue 3B = 3BO|F:W:651,5| A: 629,0. Azo Acid Blue 4B: F: W: 543,5 A: 630,5|582,0. H_2O: violet solution. HCl: red solution. NaOH: red solution. H_2SO_4: reddish-violet solution; red solution on dilution. Dyes wool navy blue from an acid bath. Level-dyeing 4; relation to cotton 3; relation to silk 3.	
Chrysoidine R, (DH) (C) Hydrochloride of *o*-toluene-azo-*m*-toluyl-	Violet crystalline powder. In water, partial absorption in blue and violet. H_2O: red solution.	See chrysoidine No 20.

ene diamine. No. 60 (69)	Alcohol: red solution. HCl to aqueous solution: light brown precipitate. NaOH: yellow precipitate. H_2SO_4: brown solution; red slimy precipitate on dilution. Dyes cotton mordanted with tannin and tartar emetic brownish-orange. Used in calico printing as a padded prepare and developed with diazotised *p*-nitroaniline or other diazo-compounds for the production of fast dischargeable browns. The white is excellent with hydrosulphite.	
Oil Yellow OB, (LDC) Yellow OB, (AAP) *o*-Toluene-azo-β-naphthylamine. No. 61	Orange paste or powder which crystallises from alcohol in orange-red plates, M. P. 126°. The minimum melting point permitted when used for colouring foodstuffs or drugs is 122°. H_2O: insoluble. Alcohol: orange-yellow solution. HCl to alcoholic solution: reddened. NaOH to alcoholic solution: unaltered. H_2SO_4: reddish-violet solution; red solution, and then orange-brown precipitate on dilution. HNO_3: red. Used for colouring foodstuffs.	
Cochineal Scarlet 2R (Sch) Sodium salt of *o*-toluene-azo-α-naphthol-5-sulphonic acid. No. 62.	A cinnabar-red powder. H_2O: sparingly soluble in cold, readily soluble in hot water, with a yellowish-red colour. HCl: flocculent red precipitate. NaOH: orange solution. H_2SO_4: magenta-red solution; red flocculent precipitate on dilution. Dyes wool from an acid bath bluish-scarlet, moderately fast to light, milling and acids.	
Crocein Orange R, (Br) (By) (tM) Brilliant Orange O, (MLB) Orange GT, RN, N, (By) (C) (K) Sodium salt of toluene-azo-β-naphthol-6-sulphonic acid. No. 63 (70)	Scarlet-red powder. H_2O: orange-yellow solution. Alcohol: orange-yellow solution. HCl: to aqueous solution: separation of brown oily drops. NaOH: dark brownish-red solution. H_2SO_4: red solution; brown oily drops on dilution. HNO_3: orange. Dyes wool orange-yellow from an acid bath or from a neutral bath. Level-dyeing 2; relation to cotton 3–4, relation to silk 3–4. Light: 3–4. Used particularly for dark compound shades, such as brown, bronze, olive, etc., for dyeing piece goods, yarns, embroideries etc. and for colouring paper. Discharged well by hydrosulphite.	Not much used.
Ponceau RT, (LDC)	Red powder. H_2O: yellowish-red solution	

Ponceau Scarlet (WSS) Sodium salt of toluene-azo-β-naphthol-3:6-disulphonic acid. No. 64	HCl: unaltered NaOH: yellowish-brown solution. H_2SO_4: cherry-red solution, yellowish-red solution on dilution. Light: 3–4. Dyes wool yellowish-red from an acid bath.	
Naphthamine Fast Bordeaux, BR, BG, (K) Naphthamine Fast Scarlets (K) Sodium salt of *o*-toluene-azo-α-naphthol-5:6-phenocarbazol-3-sulphonic acid. No. 65	BR: brownish-violet powder; BG, brown powder. H_2O: BR, magenta-red solution; BG, bluish-red solution. HCl: BR, red-brown gelatinous precipitate; BG, crimson precipitate. NaOH: BR, violet precipitate; BG, crimson precipitate. H_2SO_4: BR, pure blue solution, red-brown precipitate on dilution; BG, wine-red solution, violet solution, and then red-brown precipitate on dilution. Light: 3. Whereas BR is a single substance, BG is a mixture of two dyes. F: Naphthamine Fast Bordeaux not a mixture (Naphthamine Fast Scarlets B, R, 4B, 8B, BS are direct cotton dyestuffs).	
Azo Fuchsine B, (By) Sodium salt of toluene-azo-1:8-dihydroxy-naphthalene-4-sulphonic acid. No 66 (71)	A black-brown powder. In water $\lambda = 522.2$ F: W: 525,0 A: 538,5 577,0[2]. HCl: reddish-brown precipitate soluble in water. NaOH: bluer solution. H_2SO_4: violet solution, bluish-red solution on dilution. Dyes wool from an acid bath level magenta-red, converted into violet-black by after-chroming. Scarcely stains silk in a boiling acid bath. Excellent product.	
Persian Yellow (Gy) *o*-Nitro-*p*-toluene-azo-salicylic acid. No. 67	A brownish-yellow 20% paste. Crystallises from dilute alcohol in yellow needles, M. P. 213°. H_2O: yellow solution on boiling. Alcohol: yellow solution on boiling. HCl to aqueous solution: yellow precipitate. NaOH: orange-brown solution. Alkaline hydrosulphite: yields *p*-hydroxyphenyltoluylene triazol carboxylic acid, (white needles from acetic acid, M. P. 276°). H_2SO_4: orange-yellow solution; brownish-yellow precipitate on dilution. HNO_3: red. Dyes chrome-mordanted wool yellow. Used also in calico printing with chromium acetate. Partly a mixture obtained by the interaction of Persian berry extract and *p*-nitro-diazo-aniline. One of the best yellows for calico printing.	

In Substance: Pigment Orange L, R paste, (MLB) Fast Orange, (By) *The Amine:* Fast Scarlet G Base (GrE) Nitrotoluidine Orange Base (MLB) *m*-Nitro-*o*-toluene - azo-*β*-naphth l. No. 68 (72)	Orange paste. Crystallises from acetic acid in long red-brown needles, M. P. 206°. H_2O: insoluble. Alcohol: soluble with a yellowish-orange colour on boiling. HCl to alcoholic solution: redder. NaOH: unaltered. H_2SO_4: cherry-red solution; orange precipitate on dilution. HNO_3: red. Used for pure orange coloured lakes, very fast to water and lime, of good fastness to light, and moderately fast to spirit and oil. Light 1–2. Nitrotoluidine Orange Base (MLB): brownish-yellow powder, M. P. 105°. Dyes cotton padded with *β*-naphthol and developed with the diazotised base bright orange, fast to light and soap, but not to rubbing. A yellow shade of red is obtained with Naphthol AS. Both shades are discharged by hydrosulphite and resist oxidation discharges satisfactorily.	
In Substance: **Monolite Fast Scarlet** R, (BDC) **Helio Fast Red** RL, RL pdr., (By) Helio Red RL, (Gy) **Lithol Fast Scarlet** NRN, R, RPN, (B) Pigment Fast Red HL, (MLB) *o*-Nitro-*p*-toluene-azo-*β* naphthol. No. 69 (73) *The Amine:* Nitrotolindine base HR (By) *m*-Nitro-p-Toluidine (Sr E) Nitrotoluidine G (C)	Orange paste, orange-red lumps, or orange-red powder. Crystallises from acetic acid in long red needles, M. P. 258°. H_2O: insoluble. Alcohol: soluble, with a yellow colour on boiling. HCl to alcoholic solution: unaltered. NaOH: unaltered. H_2SO_4: deep violet solution; red precipitate on dilution. HNO_3: red-orange. Used for yellowish-red colour lakes. The lakes possess excellent fastness to light, good fastness to water and lime, and sufficient fastness to spirit and oil. The lakes are unaffected by heating to 150°C. Light: 1–2. *m*-Nitro-*p*-toluidine Base: brown crystalline powder, M. P. 112°. Dyes cotton padded with *β*-naphthol and developed with the diazotised base reddish-orange.	Important.
Printing Paste: **Rapid Fast Red** GL, (GrE) *On the Fibre:* Fast Red G, (GrE) Nitrosamine from diazotised-*m*-nitro-*p*-toluidine with *β*-hydroxynaphthoic acid anilide. No. 70	A yellowish-brown alkaline paste. When boiled with water coupling occurs, with the formation of the azo compound, which crystallises from acetic acid in red-brown needles, M. P. 284°. *Paste:* H_2O: brown solution. HCl: faintly pink precipitate which crystallises from acetic acid in plates or needles, M. P. 240° (*β*-hydroxynaphthoic acid anilide). NaOH: unaltered. *Azo Compound*	Very important.

	H_2SO_4: deep violet solution, red precipitate on dilution. Used in calico printing for a fast red, which is developed by steaming and is very similar to Alizarine Red. Discharged well by hydrosulphite and resists oxidation discharges well.	
New Phosphine G (C) Hydrochloride of dimethylamino-benzyl-azo-resorcinol. No. 71 (75)	Yellowish-brown powder. In water, partial absorption in blue and violet. H_2O: yellowish-brown solution. HCl: unaltered. NaOH: redder and darker solution. H_2SO_4: yellowish-brown solution, unaltered on dilution. Dyes leather and cotton mordanted with tannin and tartar emetic yellow. Moderately fast to washing. Used for calico printing and unions.	
Tannin Orange R (C) Hydrochloride of dimethylamino-benzyl-azo-β-naphthol No. 72 (74)	Brown powder or 50% paste. The pure azo dye from the *p*-compound crystallises from dilute alcohol in red needles, M. P. 120°. In water λ 515.2 and λ = 483.7. H_2O: sparingly soluble, with a brown colour. Alcohol: readily soluble, with a brown colour. HCl to alcoholic solution: orange-brown precipitate. NaOH: yellowish-brown precipitate. H_2SO_4: cherry-red solution; orange-brown precipitate on dilution. Light: 3. Dyes leather and cotton mordanted with tannin and tartar emetic very bright orange, moderately fast to soap, light, and acids. Used also for calico printing and half-silk.	
Sudan II (A) (K) Red B, (B) Motirot G (FM) Xylene-azo-β-naphthol. No. 73 (76)	Brownish-red powder. H_2O: insoluble. Alcohol: yellowish-red solution. H_2SO_4: magenta-red solution; pale yellow precipitate on dilution. HNO_3. Light: 2–3. Used for colouring spirit varnishes, fats, oils &c., yellowish-red.	
Azococcin 2R (A) *Jute Scarlet* (*ACC*) *Ponceau* R conc. (B) for Trite *Sodium salt of xylene-azo-α-naphthol-4-sulphonic acid.* No. 74 (77)	A reddish-brown powder. Azococcin: F. λ = 501,0 542,0. A: 503,0 540.5 H_2O: rather difficultly soluble, with a red colour. HCl: brownish-red flocculent precipitate. NaOH: brownish-yellow-solution. H_2SO_4: magenta-red solution; brownish-red precipitate on dilution. Dyes wool, silk, and half-silk moderately level red from an acid bath.	

	It is sensitive to metals and is precipitated in the bath by alum. Light: 2–3.	
Cochineal Scarlet 4R, (Sch) Sodium salt of xylene-azo-α-naphthol-5-sulphonic acid. No. 75 (78)	A fiery-red powder which forms insoluble calcium and magnesium salts. H_2O: difficultly soluble with a red colour. HCl: reddish-brown precipitate. NaOH: yellowish-red solution. H_2SO_4: magenta-red solution, reddish precipitate on dilution. Dyes wool from an acid bath red, moderately fast to light and stoving. Light: 3.	
Wool Scarlet R (Sch) Sodium salt of xylene-azo-α-naphthol-4:8-disulphonic acid. No. 76 (80)	Brownish-red powder. H_2O: yellowish-red solution. Alcohol: very difficultly soluble. HCl to aqueous solution: bluish-red solution. NaOH: yellowish-red solution. H_2SO_4: cherry-red solution; red solution on dilution. Dyes wool from an acid bath red, moderately fast to light, washing, acids, alkalies, milling and stoving. Light: 3–4.	Scarcely on the market.
Palatine Scarlet **Brilliant Cochineal** 2R, 4R, (C) (B), A (B) Cochineal Scarlet PS, (By) **Brilliant Wool Scarlet** (K) Sodium salt of *m*-xylene-azo-α-naphthol-3:6- disulphonic acid. No. 77 (81)	A brownish-red powder. In water $\lambda = 540.5$ and $\lambda = 502.4$. F: W: 504,0| 543,8. A: 499,0| 536,5. H_2O: scarlet-red solution. Alcohol: scarlet-red solution. HCl: yellow-brown gelatinous precipitate. NaOH: yellower solution. H_2SO_4: bluish-red solution, yellowish-brown precipitate on dilution. Dyes wool bright scarlet-red from an acid bath. Level-dyeing 3–4; relation to cotton 2–3; relation to silk 3. Light: 2–3. Used largely as a substitute for cochineal in piece dyeing.	Much in use.
Brilliant Orange H, R, (MLB) Scarlet G, GR, RL, (A), (By) Orange L, (SrE) A (B) H (K) Ponceau 2G, (B) Sodium salt of xylene-azo-β-naphthol-6-sulphonic acid. No. 78 (79)	A cinnabar-red powder. In water, $\lambda = 490$. H_2O: reddish-yellow solution. Alcohol: reddish-orange solution. HCl to aqueous solution: brownish-red precipitate. NaOH: unaltered. H_2SO_4: cherry-red solution; brownish-red precipitate on dilution. HNO_3: red. Dyes wool and silk yellowish-red from an acid bath. Level-dyeing 2–3; relation to cotton 3–4; relation to silk 4–3. Light: 3. Discharged by hydrosulphite NF.	
Ponceau 2R, R, or 2R, 2RE, FR, G, RG, FRR, GR, (BDC) (A) (B), (C), (tM), (S), (A), (B), (By), (L), (M),	A bright red powder. F: R_A: W: 497,0| 535,5 A: 532,0| 496,0 G_{tM}: W: 496,5| 536,5 A: 495,5| 531,0 R, RR: W: 499,5| 540,5 A: 497,0| 535,5 2 R: W: 498,5| 538,0 A: 498,0| 535,5 In water $\lambda = 539.5$ and $\lambda = 501.5$	The most important Ponceau.

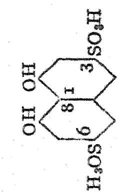
(tM), (Gy), (C). (MLB) Scarlet R, 2R, (BDC) Brilliant Ponceau G, (C) R (tM) *Ponceau* 2*R*-Sodium salt of *m*-xylene-azo-β-naphthol-3:6-disulphonic-acid. No. 79 (82)	(Ponceau G MLB) in water $\lambda = 492.6$). H_2O: yellowish-red solution. Alcohol: insoluble. HCl to aqueous solution: unaltered. NaOH: yellower and darker solution. H_2SO_4: cherry-red solution; reddish-yellow solution on dilution. HNO_3: Bordeaux-red. Dyes wool scarlet-red from an acid bath. Level-dyeing 3; relation to cotton 2; relation to silk 3. Used also for colouring food. Ponceau R (S) is discharged white on wool by hydrosulphite. In dyeing it is sensitive to iron, and it is precipitated quantitatively as the carmine lake on alumina.	
Ponceau 3R, 3R certified, FRRR, 4R, (A) (B) (GrE) (K) (MLB) (C) (A) Scarlet S3R (B) *Ponceau* 4*R*-Sodium salt of α-cumene-azo-β naphthol-3:6-disulphonic acid. No. 80 (83)	A dark-red powder. In water $\lambda = 541.5$ and $\lambda = 503.2$. F: W: 500,0| 539,5–541,5 A: 499,5| 535,5–537,5. H_2O:cherry-red solution. Alcohol: difficultly and only partially soluble. HCl to aqueous solution: unaltered. NaOH: yellow precipitate. H_2SO_4: cherry-red solution, unaltered on dilution. HNO_3: brown-red. Dyes wool bluish-scarlet from an acid bath. Level-dyeing 3; relation to cotton 1–2; relation to silk 3. Light: 3–4. Officially permitted for colouring foodstuffs in the United States and Australia.	
Pigment Brown (B,) Sudan Brown (A), Fast Oil Brown S Brilliant Fat Brown B, (SCI) α-Naphthalene-azo-α-naphthol.	Brown powder. H_2O: insoluble. NaOH: sparingly soluble, with a wine-red colour. Alcohol: brown solution. H_2SO_4: blue solution, brown precipitate on dilution. HNO_3: violet-blue. Used for colouring oils, fats, waxes, soaps, spirit varnishes etc. Light: 3–4.	
Nr. 81 (105) *On the Fibre—* **α-Naphthylamine Claret** **Naphthylamine Bordeaux** *In Substance—* Oil Red N, BN, 2R (BDC) Bordeaux for Lakes M (Gy) Red Brown (S) (S) Autol Red RI, RIP (B) *The Amine or its Salts—*	Reddish-brown paste. It crystallises from acetic acid in bronze plates with a green reflex, M. P. 220°. In H_2SO_4: $\lambda = 627.95$ and $\lambda = 585.75$. H_2O: insoluble. Alcohol: red solution on heating. H_2SO_4: blue solution; reddish-brown precipitate on dilution. Dyes brownish-red when printed as a pigment colour with albumin on cotton, or bright claret colour when cotton padded with β-naphthol is developed with diazotised α-naphthylamine. In the latter case the material is often shaded with α-naphthol for puce.	Excellent dye for calico. Can not only be discharged as mentioned in the remarks, but also with Rhoduline scarlet or Setopaline as a catalyst.

Fast Garnet B (GrE) α-Naphthylamine Salts (MLB) α-Naphthalene-azo-β-naphthol. Nr. 82 (106)	Naphthylamine Bordeaux is discharged by rongalite in presence of catalysts, such as Induline Scarlet or anthraquinone, or without a catalyst by the use of acetaldehyde-sulphoxylate. The resistance to oxidation discharges is low. Light: 1–2. Used as an ice colour and in substance for indigo discharge printing, and for the manufacture of lakes fast to water and lime; of good fastness to light and moderately fast to spirit and oil.
Naphthine Brown A (StD) Sulphamine Brown (WDC) Components— α-Naphthylamine— Bisulphite compound of α-nitroso-β-naphthol. No. 83 (107)	A red-brown powder. H_2O: red-brown solution. HCl: brown precipitate. NaOH: red-brown precipitate. H_2SO_4: blackish-green solution, brown precipitate on dilution. HNO_3: dirty-olive. Dyes chrome-mordanted wool moderately fast dark brown. The fastness to light and milling is increased, but the fastness to alkalies is diminished by after-treatment with copper sulphate.
Double Ponceau R, 2R, 3R, 4R (By) Sodium salt of α-naphthalene-azo-α-naphthol-5-sulphonic acid. No. 84 (108)	A red powder. H_2O: orange-red solution. HCl: yellowish-brown to reddish-brown precipitate. NaOH: reddish to brown precipitate. H_2SO_4: red solution, yellowish to red precipitate on dilution. Dyes wool, from an acid bath red, very fast to acid and alkali. Discharged by zinc dust. Light: 3, but as lake: 1–2. Used for the manufacture of **Lakes** fast to light.
Palatine Red A (B) Benzyl Bordeaux B, (SCI) Guinea Bordeaux B. (A) Naphthorubine O (MLB) (By) (MLB) Sodium salt of α-naphthalene-azo-α-naphthol-3:6-disulphonic acid.	Brown powder. W: 519,5 not sharp. H_2O: bluish-red solution. Alcohol: bluish-red solution. HCl to aqueous solution: brown precipitate. NaOH: yellower solution. H_2SO_4: blue solution, reddish-brown precipitate on dilution. HNO_3: violet-blue. Dyes wool, silk, and half-silk bright bluish-red from an acid bath. Level-dyeing 4. Light: 2–3.
No. 85 (109) *Buffalo Rubine* (Sch) *Azo Bordeaux* (By) Sodium salt of α-naphthalene-azo-α-naphthol-3:6-disulphonic	Brown powder. H_2O: magenta-red solution. HCl: unaltered, or a red-violet soluble precipitate. NaOH: unaltered or a red soluble precipitate. H_2SO_4: blue solution; magenta-red solution on dilution. HNO_3: blue.

acid. Nr. 86 (110)	Dyes wool claret-red from an acid bath. Fast to acids, alkalies, and stoving, moderately fast to light, but not fast to milling. Light: 3–4. F: probably a mixture.	
Fast Red BT, B (Lev) (By) Sodium salt of α-naphthalene-azo-β-naphthol-6-sulphonic acid. Nr. 87 (111)	A red powder. H_2O: red solution. Alcohol: slightly soluble. HCl to aqueous solution: dark reddish-brown precipitate. NaOH: brown solution. H_2SO_4: violet solution, reddish-brown precipitate on dilution. Dyes wool red from an acid bath. Light: 3–4.	
Fast Red B, BN, B, P, (B) (B) (L) (By) Pure Bordeaux B, (BDC) Bordeaux B, BL, R extra, (H) (S) (SCI) (A) (C) (MLB) (tM) (C) (MLB) Sodium salt of α-naphthalene-azo-β-naphthol-3:6:-disulphonic acid. R Nr. 88 (112)	Brown powder. In water, $\lambda = 523$. F: W: 520,0 A: 505,0 H_2O: magenta-red solution. Alcohol: moderately soluble with a bluish-red colour. HCl to aqueous solution: unaltered. NaOH: yellowish-brown solution. H_2SO_4: blue solution; magenta-red solution on dilution. HNO_3: red. Dyes wool and silk Bordeaux-red from an acid bath. Level-dyeing 4; relation to cotton 3; relation to silk 3. Light: 2–3. Used for dyeing wool and silk, for wool printing and for colouring food. Bordeaux B (S) is discharged white on wool by hydrosulphite, or cream by stannous chloride. It is precipitated quantitatively as the barium lake on alumina base.	
Crystal Ponceau, 6R (A) (B) (K) (L) Crystal Scarlet (By) (C) (MLB) Ponceau 6R (tM) Sodium salt of α-naphthalene-azo-β-naphthol-6:8-disulphonic acid. Nr. 89 (113)	Brownish-red crystals with a green reflex. W: 504,0 A: 505,0|546,5 H_2O: scarlet-red solution. Alcohol: insoluble. HCl to aqueous solution: darker solution, brown crystalline plates precipitated with excess. NaOH: brown solution. H_2SO_4: violet solution, scarlet-red solution on dilution. Dyes wool scarlet from an acid bath. Level-dyeing 4–3; relation to cotton 1–2; relation to silk 3. Light: 2–3. Used for dyeing and printing wool.	
Chromotrope **10B (MLB)** **Acid Violet** 6R (NCW) Sodium salt of α-naphthalene-azo-1:8-dihydroxynaphthalene-3:6-disulphonic acid.	Brownish-violet powder. W: 538,5| 584,0 A: 584,0|542,0. H_2O: violet solution. Alcohol: violet solution. HCl to aqueous solution: bluer solution. NaOH: yellowish-red solution. H_2SO_4: greenish-blue solution, reddish-violet solution on dilution.	An important product.

Nr. 90 (114)	Dyes wool from an acid bath reddish-violet, converted into bluish-black by after-chroming. Level-dyeing 4; relation to cotton 2; relation to silk 3. Light: 2–3.	
Palatine Scarlet 3R, 4R, (B) Palatine Scarlet 4R is a mixture of Palatine Scarlet 3R with another dye. Sodium salt of β-naphthalene-azo-α-naphthol-3:6-disulphonic acid. Nr. 91	A dark red powder. H_2O: scarlet solution. Alcohol: orange-red solution. HCl to aqueous solution unaltered. NaOH: brown solution. H_2SO_4: 3R wine-red solution; 4R violet solution; scarlet solutions on dilution. Dyes wool scarlet from an acid bath, level only in full shades. Light: 3.	
Sudan CB, (CD) Azo Turkish Red (GrE) β-Naphthalene-azo-β-naphthol. Nr. 93 (115)	*In substance:* A reddish-brown crystalline powder with a green reflex, M. P. 174°, which forms a soluble bisulphite compound. H_2O: insoluble. H_2SO_4: magenta-red solution, red-brown precipitate on dilution. HNO_3: red.	
	On the fibre— H_2O: insoluble. On heating: yellowish-red colour with a yellowish-red sublimate. Alcohol: orange solution on warming. H_2SO_4: red-violet solution, yellowish-red on dilution. Dyes cotton padded with β-naphthol and developed with diazotised β-naphthylamine scarlet-red, bluer and less fast than Para Red (Nr. 44). Light: 1–2.	
Naphthine Brown B, (StD) Sulphamine Brown B, (WDC) β-Naphthylamine— Bisulphite compound of α-nitroso-β-naphthol. Nr. 94 (116) *Azochromine* Conc., pdr. Chrome Deep Brown 3R (DH) *Tetrahydroxy-azobenzene* Nr. 95 (84) From p-Amino-phenol and pyrogallol.	A brown powder. H_2O: yellowish-brown solution. HCl: yellowish-brown precipitate. NaOH: yellowish-brown precipitate. H_2SO_4: violet solution, yellowish-brown precipitate on dilution. Dyes chrome-mordanted wool chocolate-brown. Light: 2–3. Dark brown 30% paste. H_2O: insoluble cold, soluble with a dark yellow colour on boiling. Alcohol: dark yellow solution. HCl to alcoholic solution: unaltered by dilute acid, red solution with concentrated acid. NaOH: brown solution. H_2SO_4: brown solution, brown precipitate on dilution. HNO_3: brown, decomposition. Dyes chrome-mordanted wool and cotton dark brown. Used for wool dyeing and calico printing. Light: 2–3.	Mostly used for calico printing on account of its good solubility.
Omega Chrome Black PV, PB (S)	*Omega Chrome Black PV, PB,* A brownish-black powder.	

Omega Chrome Blue B, R (S) **Omega Chrome** Black Sodium salt of 2-hydroxy-3-nitro-5-methyl-benzene-azo-phenyl-α-naphthylamine-8-sulphonic acid. Nr. 96 (85)	H_2O: readily soluble, with a brownish-red colour. Alcohol: bluish-red solution. HCl to aqueous solution: blue precipitate. NaOH: yellowish-red solution. H_2SO_4: Omega Chrome Black PV, PB, violet solution; Omega Chrome Blue B, R, bluish-black solution, dark blue precipitate on dilution. HNO_3: violet. Dyes wool from an acid bath, Omega Chrome Black PV, PB, brownish-violet; Omega Chrome Blue B, R, reddish-violet, converted into dark blue to black by after-chroming. Fast to light, acids, alkalies and milling. *Omega Chrome Black P:* HCl to aqueous solution: brown precipitate. NaOH: bluish-red solution. H_2SO_4: blue solution, dark violet precipitate, and then browner precipitate on dilution. Light: 2. *Omega Chrome Blue R* Spectrum F: W: 535,0 A: 547,5	
Azarine *S (MLB)* *Ammonium bisulphite* compound of 2-hydroxy-3:5-dichlorobenzene-azo-β-naphthol. Nr. 97 (86)	Yellow paste with an odour of sulphur dioxide. H_2O: sparingly soluble with a yellow colour. Alcohol: dark yellow solution. HCl: orange-yellow precipitate. NaOH: violet precipitate, red solution on boiling. H_2SO_4: magenta-red solution, reddish-brown precipitate on dilution. Used in calico printing for bright pink and red shades, fast to light, and in dyeing silk and cotton for shades fast to washing but not to light. The shade is developed by steaming, boiling with water, or by alkalies. Light: 2.	Scarcely used.
Palatine Chrome Brown 2G, (B) *Chrome Brown* TV, R (K) (StD) Alizarine Brown R (T) Sodium salt of 5-nitro-2-hydroxy-benzene-azo-*m*-phenylene-diamine sulphonic acid. Nr. 98	A chocolate-brown powder. H_2O: orange-brown solution. HCl: bluish-red precipitate. NaOH: unaltered. H_2SO_4: red-brown solution, crimson solution, brown solution, and then brown precipitate on dilution. Dyes chrome-mordanted wool brown. Light: 3–4.	Very little used.
Palatine Chrome Green G (B) **Chromanthrene Green H** (BDC) **Eriochrome Green H**	Dark red-brown powder. H_2O: dark reddish-violet solution. HCl: red precipitate. NaOH: Bordeaux-red solution. H_2SO_4: reddish-violet solution, red precipitate on dilution.	

(Gy) **Chrome Fast Green G** (SCI) **Sodium salt of 5-nitro-**2-hydroxy-benzene-azo-8-amino-1-naphthol-3:6-disulphonic acid.	Dyes wool from an acid bath and is converted by after-chroming into dark green, fast to washing and milling. Used in wool dyeing and calico printing with a chromium mordant, and in lake manufacture. Light: 3.	The **cheapest** chrome green. Not fast to potting. Not good enough for uniforms.
Nr. 99 Cyprus Blue R (A) **Peri Wool Blue B, BS, S (C)** Nitroaminophenols-Peri-derivatives of naphthalene. Nr. 100 (87)	*Peri Wool Blue B:* A reddish-brown powder. H_2O: reddish-violet solution. HCl: red solution. NaOH: magenta-red solution. H_2SO_4: red solution; bluish-red solution on dilution. *Peri Wool Blue G:* A grey powder. H_2O: blue solution. HCl: crimson solution. NaOH: unaltered. H_2SO_4: red solution, crimson solution on dilution. Dyes wool from an acid bath. *Peri Wool Blue B*, navy blue; *Peri Wool Blue G*, greenish-blue. The dyeings when treated with copper salts are very fast to light, washing, acids, and alkalies, and sufficiently fast for light milling. Light: 1–2. Used in piece dyeing and for dyeing carpet yarns. Many brands are mixtures.	Mostly Azo dyes with chromotropic acid:  Analogous: *Cashmere blue* Chloraminophenol + H-acid (coupled in acid solution).
Metachrome Brown B paste, (A) Alizadine Brown (BDC) 2-Hydroxy-3: 5-dinitrobenzene-azo-*m*-toluylenediamine. Nr. 101 (89)	A brown paste which is explosive in the dry state. H_2O: insoluble cold, orange-red solution hot. HCl: blackish-brown precipitate. NaO: violet-brown precipitate. H_2SO_4: red solution with a bluish tint; brown solution and then brown precipitate on dilution. HNO_3: greenish. Dyes wool in presence of metachrome mordant (ammonium sulphate and potassium chromate) or chrome-mordanted wool dark brown, fast to light, weather and milling. Light: 1–2. Used also in calico printing for the production of dull brown and drab shades with a chromium mordant. **Explosive.**	
Chrome Olive (Br) 2-Hydroxy-3:5-dinitrobenzene-azo-β-naphthylamine. Nr. 102	A purple-brown paste. H_2O: insoluble cold, soluble hot. HCl: dull violet precipitate. NaOH: brown precipitate. H_2SO_4: brownish-red solution, violet-brown precipitate on dilution. Dyes wool in a single bath with metachrome mordant olive-green of excellent fastness to light, alkalies, washing and milling. Light: 1–2.	

Metachrome Brown Y (Br) 2-Hydroxy-3:5-dinitrobenzene-azo-*o*-cresol. Nr. 103.	A chocolate-brown paste. H_2O: orange-brown solution. HCl: brown precipitate. NaOH: red brown solution. H_2SO_4: (dry powder) orange solution, brown precipitate on dilution. Dyes wool in a single bath with metachrome mordant brown. Light: 1–2. Used also in calico printing with chromium mordants for the production of fast dull brown and drab shades.	
Solochrome Brown H,O (BDC) **Metachrome Olive Brown** G, (Br) (A) 2-Hydroxy-3:5-dinitrobenzene-azo-*p*-cresol. Nr. 104	Blackish-brown powder or paste. H_2O: brown solution. HCl: brown precipitate. NaOH: redder solution. H_2SO_4: orange-brown solution, brown precipitate on dilution. HNO_3: red-brown. Dyes wool in a single bath with metachrome mordant olive-b own of good fastness to light, washing, milling, rubbing, stoving, acids and alkalies. Light: 2.	Fairly widely used.
Acid Anthracene Brown R (By) Picramic acid Substituted *m*-phenylene-diamine sulphonic acid (Glycin). Nr. 105 (88)	A dark olive-green powder. H_2O: reddish-brown solution. Alcohol: almost insoluble. HCl to aqueous solution: yellowish-brown solution. NaOH: unaltered. H_2SO_4: reddish-violet solution; yellow-brown solution on dilution. Dyes wool from an acid bath and after-chromed chestnut-brown. Important for leather. Light: 2–3.	
Chrome Brown P (StD) 2-Hydroxy-3:5-dinitrobenzene-azo-*m*-amino-phenol (or its glycine). Nr. 106 (90)	A brown paste. H_2O: reddish-brown solution. HCl: brown precipitate. NaOH: unaltered. H_2SO_4: brownish-red solution, brown precipitate on dilution. HNO_3: brown. Dyes chrome-mordanted wool bright brown, fast to washing and milling. Light: 1–2.	
Metachrome Bordeaux R paste, B paste. (Br) (A) 2-Hydroxy-3:5-dinitrobenzene-azo-*m*-toluylene-diamine-*p*-toluene-sulphonamide. Nr. 107 (92)	Metachrome Bordeaux R. A brownish-red paste. H_2O: almost insoluble cold, orange-brown solution on heating. HCl: orange-yellow precipitate. NaOH: violet solution and precipitate. H_2SO_4: red-violet solution, brown precipitate on dilution. HNO_3: pink. Dyes wool in a single bath with metachrome mordant Bordeaux-red of excellent fastness to milling and dry-steaming, and of good fastness to light and acids. Light: 2.	
Alliance Fast Green 2G (BDC) Khaki Green	Dark-brown powder with a faint coppery lustre. H_2O: brownish-red solution.	

W (BDC) Anthracyl Chrome Green A, D (WDC) 2-Hydroxy-3:5-dinitro-benzene-azo-α-naphthylamine-4-sulphonic acid. Nr. 108 (91)	HCl: Bordeaux-red solution and precipitate. NaOH: unaltered, or red precipitate with excess. H_2SO_4: red solution, chocolate-brown crystalline precipitate on dilution. Dyes wool from an acid bath level violet-brown, converted by after-chroming into olive-green, fast to light and milling; also wool from a single bath with metachrome mordant. It is sensitive to copper and iron, and the presence of traces of the former in the wool or in the dye-bath prevents the development of the olive-green shade. Light: 2–3. Anthracyl chrome green A, is a mixture of red, blue and yellow.	
Dutch Yellow (FA) *Mordant Yellow* GRO (B) Sodium salt of diphenyl-azo-salicylic acid diazo-sulphonate. Nr. 109 (103)	A yellow powder. H_2O: yellow solution. Alcohol: slightly soluble. HCl to aqueous solution: light brown precipitate. NaOH: yellowish-red solution. H_2SO_4: Bordeaux-red solution, yellow precipitate on dilution. Dyes chrome-mordanted wool, brownish-yellow.	Scarcely used.
Diamond Flavine G (GCC) (By) *p*-Hydroxydiphenyl-azo-salicylic acid. Nr. 110 (102)	Yellowish-brown paste or powder. In water, partial absorption in blue and violet. H_2O: the paste is insoluble, but dissolves on adding sodium acetate; the powder is readily soluble. Alcohol: yellowish-brown solution on heating. HCl to alcoholic solution: unaltered. NaOH: reddish-orange solution. H_2SO_4: blood-red solution, yellowish-brown precipitate on dilution. HNO_3: dark red. Dyes chrome-mordanted wool, or wool from an acid bath and after-chromed, or wool from a single bath with metachrome mordant yellow, fast to acids and alkalies; stoving 4; milling, white cotton is stained. Light: 2–3. Used as a cheap substitute for fustic in dyeing wool and in calico printing.	Scarcely used.
Benzoyl Pink (StD) Sodium salt of benzoyl-amino-ditolyl-azo-α-naphthol-4-sulphonic acid. Nr. 111 (104)	A brick-red paste. HCl: violet precipitate. NaOH: brick-red solution. H_2SO_4: bluish-red solution, violet precipitate on dilution. Dyes cotton direct pink.	Not used.
Chrome Fast Yellow GG (A) **Alizarine Yellow**	A light yellow powder or yellow paste; crystallises from toluene in brown leaflets, M. P. 196°.	

5G (SCI) 2-Anisole-azo-salicylic acid. Nr. 112 (96)	H_2O: yellow solution on boiling. HCl: yellow precipitate, rendered more gelatinous and garnet-red with excess. NaOH: orange-red solution and precipitate. H_2SO_4: yellowish-red solution and then yellow solution and yellow precipitate on dilution. HNO_3: red-yellow. Dyes chrome-mordanted wool and silk level greenish-yellow. Light: 2. Used also in calico printing with a chromium mordant for greenish-yellow shades. Alizarine yellow 6G (see No. 122).	Very good product.
In Substance— **Brilliant Fat Scarlet (SCI)** Sudan R (A) Pigment Purple (MLB) *The Amine—* Fast Red— BB Base *Stabilised diazotised* Azophor Pink A (MLB) 2-Anisole-azo-β-naphthol. Nr. 113 (93)	In substance: red paste; separates from glacial acetic acid as a red crystalline powder with a bronze-reflex, M. P. 180°. H_2O: insoluble. Alcohol: red solution on boiling. HCl to alcoholic solution: dark red precipitate. NaOH: unaltered. H_2SO_4: bluish-red solution, red precipitate on dilution. HNO_3: red-brown. Used for the manufacture of bluish-red lakes for printing inks of excellent fastness to lime and water, moderate fastness to light and moderate fastness to spirit and oil. Light 2–3. *o-Anisidine-oil*, B. P. 218°. Dyes: cotton padded with β-naphthol and developed with the diazotised base scarlet. Used in calico printing. Discharged white by hydrosulphite.	
Azoeosine **G (By) (K)** Cochineal Scarlet R (WDC) Saureeosin 5B (H) Sodium salt of 2-anisole-azo-α-naphthol-4-sulphonic acid. Nr. 114 (94)	A red powder. F: W: 507,0 549,0 A: 506,0 564,0 H_2O: red solution. Alcohol: slightly soluble. HCl to aqueous solution: brownish-orange precipitate. NaOH: yellowish-brown solution. H_2SO_4: carmine-red solution, brownish-orange precipitate on dilution. HNO_3: brick-red. Dyes wool from an acid bath bluish-red, moderately fast to light and washing, and of good fastness to acids, alkalies and stoving. Light: 2–3.	Classical product of C. Duisberg. One of the first really good scarlets.
Azocochineal (By) Cochineal Scarlet B (WDC) Sodium salt of 2-anisole-azo-α-naphthol-4:8-disulphonic acid. Nr. 115 (95)	A red powder. F: W: 506,5 546,5 A: 507,0 546,0 H_2O: red solution. Alcohol: insoluble. HCl to aqueous solution: unaltered. NaOH: unaltered. H_2SO_4: dark red solution; red solution on dilution. HNO_3: first blue then orange. Dyes: wool from an acid bath scarlet, moderately fast to light, and of	

	excellent fastness to acids, alkalies and stoving. Light: 2–3.	
The Amine or its Hydrochloride— *Fast Red* R Base (GrE) Chlor Anisidine P (B) Chlor Anisidine Salt M (MLB) *On the Fibre*— Chlor-Anisidine Scarlet (MLB) 5-Chloro-2-anisole-azo-β-naphthol. No. 116 (97)	Cotton padded with β-naphthol and developed with diazotised *m*-chloro-*o*-anisidine bright scarlet-red. Used in calico printing. *In substance:* Red paste; crystallises from toluene in dark red prismatic needles, M. P. 203°. Light: 1–2.	Still better are the combinations with the Naphthol-A. S., A. N. etc.
On the Fibre— Ice Pink (SAPC) *The Amine*— Nitroanisidine (A) Tuscaline Red Base (B)	Dyes cotton padded with β-naphthol and developed with diazotised *p*-nitro-*o*-anisidine bright pink of only moderate fastness to light, but much more resistant to dry-steaming than Para Red (No. 44). Used also in calico printing.	Better with Naththol A. S., A. N. etc.
Fast Red **B Base (GrE)** *Stabilised diazotised p-Nitro-o-anisidine*— Nitrosamine Pink BX, (B) Azo Pink NA, (MLB) Nitroanisidine A (A) 4-Nitro-2-anisole-azo-β-naphthol. No. 117 (98)	*In substance:* Red powder; separates from toluene in bunches of small red crystals with a green reflex, M. P. 272°. Light: 1–2.	
In Substance— Azo Orange NA (MLB) Tuscalin Orange G (B) *The Amine*— *Tuscalin Orange* (B) *Fast Scarlet* *R Base (GrE)* 5-Nitro-2-anisole-azo-β-naphthol. No. 118 (99)	*In substance:* yellow-brown paste; crystallises from toluene in glistening red plates, M. P., 229°. H_2O: insoluble. Alcohol: reddish-yellow solution on heating. HCl to alcoholic solution: unaltered. NaOH: unaltered. H_2SO_4: reddish-violet solution, reddish-yellow precipitate on dilution. Used for the manufacture of yellowish-orange lakes of excellent fastness to light, water and lime, and moderately fast to oil and spirit. Light: 1–2. *On the Fibre*— Dyes cotton padded with β-naphthol and developed with diazotised *m*-nitro-*o*-anisidine orange. Used in calico printing.	
Eosamine B, G (A) Sodium salt of the	A reddish-brown powder. B: W: 542,5|501,5 A: 506,0|545,0 G: W: 498,5|537,5 A: 498,5|536,4	

methyl ether of *p*-cresol-azo-*α*-naphthol-3:8, disulphonic acid. No. 119 (100)	H_2O: bluish-red solution. HCl: unaltered. NaOH: yellower solution. H_2SO_4: violet-blue solution, bluish-red solution on dilution. Dyes wool and silk level bluish-red from an acid bath. Light: 2–3. Used also for delicate pink shades in dyeing wool.	
Coccinine *B, C, (MLB)* Sodium salt of the methyl ether of *p*-cresol-azo-*β*-naphthol-3:6-disulphonic acid. No. 120 (101)	A dark red powder. H_2O: cherry-red solution. HCl: darker red solution. NaOH: brown precipitate, soluble with a reddish-brown colour. H_2SO_4: cherry-red solution, unaltered on dilution. Dyes wool red from an acid bath. Light: 3–4. Level-dyeing 4	
On the Fibre— *Azo Pink* *BB (MLB)* Benzyl ether of *p*-cresol-azo-*β*-naphthol. No. 121.	Dyes cotton padded with *β*-naphthol and developed with diazotised *m*-amino-*p*-cresol benzyl ether bright pink of only moderate fastness to light. Light: 3. Used also in calico printing.	
Azo Alizarine Yellow 6G (DH) **Alizarine Yellow** (MLB) **Erio Chrom Yellow 6G** 4-Phenetole-azo-salicylic acid. No. 122. *On the Fibre—* Nitrophenetidine Red (MLB) *The Amine—* Blue Red O (MLB) 2-Nitro-4-phenetole-azo-*β*-naphthol. No. 123	A pure greenish-yellow powder or paste. Separates from alcohol as a greenish crystalline powder, M. P. 208°. H_2O: soluble, hot, with a yellowish-brown colour. Alcohol: yellow solution. HCl to aqueous solution: yellow precipitate, reddened by excess. NaOH: orange solution. H_2SO_4: orange-brown solution; orange solution and then yellow precipitate on dilution. HNO_3: red, then colourless. Dyes chrome-mordanted wool, or wool from an acid bath and after-chromed, greenish-yellow; faster shades are obtained by the latter method. Level-dyeing 2–1. Light: 1–2. Used also in calico printing with a chromium mordant for the production of bright yellow shades. Dyes cotton padded with *β*-naphthol and developed with diazotised *o*-nitro-*p*-phenetidine pink to bluish-red. Used also in calico printing. Light: 2. *In substance:* red powder; crystallises from toluene in small red plates, M. P. 169°.	The best Azo-chrome yellow.
Chromazone Red A *(Gy)* Sodium salt of benzaldehyde-azo-1:8-dihydroxynaphthalene-3:6-disulphonic acid.	A brown-red powder. H_2O: red solution. HCl: light red precipitate. NaOH: carmine-red solution. H_2SO_4: blue solution; red solution on dilution.	Not manufactured

No. 124 (129)	Dyes wool from an acid bath or chrome-mordanted wool and silk level bluish red, moderately fast to light and washing, and of good fastness to acids and alkalies. F: A mixture of yellow and red.	
Chromazone Blue R (Sy) Phenyl-ethylhydrazone of Chromazone Red (No. 124) No. 125 (130)	A dark brown powder, with a faint bronze lustre. H_2O: bluish-violet solution. HCl: red solution with a faint precipitate. NaOH: purple-red solution. H_2SO_4: bluish-red solution; red solution and precipitate on dilution. Dyes wool from an acid bath or chrome-mordanted wool reddish-blue.	Not manufactured.
Erika 2GN, (A) Direct Rose G, (S) Direct Pink Diamine Rose GN, (C) New Direct Pink (Gy) is a similar dyestuff. Sodium salt of benzenyl-amino-thiotoluidine-azo-α-naphthol-3:8-disulphonic acid. No. 126 (117)	A greyish-red powder. W: 503,5|542,5 A: 545,0|505,5 H_2O: cherry-red solution. HCl: scarlet-red precipitate. NaOH: bluish-red precipitate. H_2SO_4: bluish-red solution, scarlet-red precipitate on dilution. HNO_3: pink-red. Dyes cotton direct bluish-pink from a Glauber's salt bath, and wool red. Light: 3–4. Used also in calico printing. Discharged white by hydrosulphite or stannous chloride.	
Geranine 2B, G, (By) Brilliant Geranine B, 2BN, 3B, (By) Geranine-sodium salt of benzenyl-amine-thiocresol-azo-a-naphthol-3-sulphonic acid. No. 127 (118)	*Geranine 2B:—* A brown powder. H_2O: red solution. HCl: red precipitate. NaOH: soluble reddish-violet precipitate. H_2SO_4: violet solution, pink precipitate on dilution. HNO_3: brick-red. *Geranine G:—* A brownish-red powder. H_2O: red solution. HCl: red solution. NaOH: cherry-red solution and precipitate. H_2SO_4: violet solution, orange-red precipitate on dilution. *Brilliant Geranine 3B:—* A reddish-powder. *B*: F: W: 522,0 A: 549,5|508,0 H_2O: red solution. HCl: red precipitate. NaOH: unaltered. H_2SO_4: blue solution, red precipitate on dilution. Light 3–4. Dyes cotton direct from a boiling alkaline bath containing 10% of Glauber's salt and 2% of soap yellowish-pink to bluish-pink, moderately fast to washing, acids, light and chlorine.	

	Used for dyeing cotton, wool, silk and unions and also in calico printing.	
Diamine Pink, 2B *Diamine Rose* B, BD, BG, GD, GGN, (C) Dianil Pink BD (MLB) Sodium salt of benzenylamino-thiocresol-azo-8-chloro-a-naphthol-3:6-disulphonic acid. No. 128 (119)	A dull Bordeaux red powder. B. W: 522,0 A: 548,5 | 509,5 BG. W: 521,5 A: 546,5 | 508,5 H_2O: magenta-red solution. HCl: red solution or red precipitate. NaOH: bluer and darker solution. H_2SO_4: reddish-violet solution; red solution and red precipitate on dilution. HNO_3: pink. Dyes cotton direct, unions, half-silk and artificial silk pink. Light: 3–4. Used also in calico printing. Discharged white by hydrosulphite or stannous chloride.	
Salmon Red (A) Sodium salt of 2-methyl-4-benzenyl-amino-thio-xylenol-azo-β-naphthyl-amino-3:6-disulphonic acid. No. 129 (120)	A red powder. H_2O: orange-red solution. HCl: garnet-red precipitate. NaOH: soluble red precipitate. H_2SO_4: violet solution, garnet-red precipitate on dilution. Dyes cotton direct salmon-red. Light: 3–4. Used also for dyeing silk and half-silk, and is fast to water on silk.	
Erika **B, BN, (A) (L) B, (S)** **Z., (A)** **Direct Pink** B, (SCI) Sodium salt of 2-methyl-4-benzenyl-amino-thio-xylenol-azo-α-naphthol-3:8-disulphonic acid. No. 130 (121)	A reddish-brown powder. In water: $\lambda = 551.4$ and $\lambda = 514$. For: W: 512,5 | 553,0 | A: 508,5 | 548,5 H_2O: red solution. Alcohol: red solution. HCl to aqueous solution: red precipitate. NaOH: bluish-red precipitate. H_2SO_4: red solution, red precipitate on dilution. HNO_3: red. Dyes cotton direct and wool, silk, unions and half-silk by the single-bath process pink. Moderately fast to light and acids on cotton; very good fastness to light and good fastness to stoving on wool and silk. Light: 3–4. Used also for printing cotton, wool and silk. Discharged white by hydrosulphite, stannous chloride, or chlorate. *Erika GN*—	**The best direct pink for cotton.**
Erika **G extra, GN,** (A) **4GN,** (A) Sodium salt of 2-methyl-4-benzenyl-amino-thio-xylenol-azo-β-naphthol-6:8-disulphonic acid. No. 131 (122)	A reddish-brown powder. W: 503,5 | 542,5 A: 545,0 | 505,5 H_2O: bluish-red solution. HCl: soluble bluish-red precipitate. NaOH: soluble violet-red precipitate. H_2SO_4: reddish-violet solution; red solution and red precipitate on dilution. HNO_3: pale-red. Dyes: cotton direct pink. *F. Erika S*, (a mixture).	

	Erika 4GN— A brick-red powder. H_2O: bluish-red solution. HCl: soluble bluish-red precipitate. NaOH: soluble bluish-red precipitate. H_2SO_4: magenta solution, red solution and red precipitate on dilution. Dyes cotton direct a yellower shade of pink than Erika GN and possesses a greater affinity for wool and silk than the latter. Fairly fast to light and good fastness to stoving on wool, and silk. Light: 2–3. Used also in calico printing. Discharged white by hydrosulphite, stannous chloride, or chlorate.	
Emin Red (A) Sodium salt of 4-methyl-2-benzenyl-amino-thio-xylenol-azo-β-naphthol-6-sulphonic acid No. 132 (123)	A red powder. H_2O: yellowish-red solution. HCl: red precipitate. NaOH: yellower solution. H_2SO_4: carmine solution, red precipitate on dilution. HNO_3: bluish-red. Dyes wool, silk, unions and half-silk level red from an acid bath. The shade is rendered duller and faster by after-chroming. Light: 3–4.	Scarcely used.
Diazine Green *S* (*K*) *Janus Green* B, G, (MLB) Safranine-azo-dimethylaniline. No. 133 (124)	A brown or dark green powder. F: W: 592,7 A: 669,5 608,7 In water: $\lambda = 597.2$ Janus greem G: W: 597,5 A: 691,5 In alcohol: $\lambda = 666.8$ and $\lambda = 608.5$. HCl: soluble blue precipitate. NaOH: black precipitate. H_2SO_4: olive-green solution; greenish-blue solution and then pure blue solution on dilution. HNO_3: dull green-blue. Dyes cotton mordanted with tannin and tartar emetic bluish-green. Light: 3–4. Used also for dyeing unions from an acid bath without mordanting the cotton. *Janus Green G* dyes a uniform shade on unions, but *Janus Green B* dyes wool more deeply than cotton.	
Diazine Black (K) **Janus Black** (MLB) Safranine-azo-phenol(?) No. 134 (125)	A blackish-brown powder. H_2O: dark greenish-blue solution. Alcohol: reddish-blue solution. HCl to aqueous solution: soluble blackish-green precipitate. NaOH: red precipitate. H_2SO_4: green solution; violet solution and then blackish-green precipitate on dilution. Dyes cotton mordanted with tannin and tartar emetic black, of good fastness and washing. Light: 3–4. Used also for dyeing unions from an acid bath a uniform shade without mordanting the cotton. Used for artificial silk. Mostly mixtures.	

Janus Blue G, R, (MLB) Indoine Blue R, BB, BR, (B) Indoine pdr. 2B, R, 2R, (Gy) Naphthindone BB, BB, BR, T Indone Blue 2B, 2R, (By) Diazine Blue BR, (K) Janus Dark Blue B, R, (MLB) Indoine Blue R-Safranine-azo-β-naphthol. No. 135 (126)	*Iodine Blue R*— A dark coloured paste or bronze powder. F: W: 542,5 A: 602,5 | 560,3 In water: $\lambda = 540.5$. In alcohol: $\lambda = 601.6$ and $\lambda = 559.5$. Mark G: W: 543,5 610,8 A: 634,1 | 588,8 H_2O: violet solution. Alcohol: bluish-violet solution. HCl to aqueous solution: blue precipitate. NaOH: blackish-violet precipitate. H_2SO_4: greenish-brown solution, green solution and then violet precipitate on dilution. Dyes cotton mordanted with tannin and tartar emetic indigo blue. Light: 3. Used also in calico printing, and for dyeing viscose silk. Discharged white by chlorate, but red effects on a blue ground are produced by printing with stannous chloride as a result of the reduction of the azo-compound with formation of Safranine (Michel).	
Methyl Indone B, R (C) Safranine-azo-amino-naphthol. No. 136 (127)	Methyl Indone B— Brown powder. F: Mark B. mixture. H_2O: blue solution. HCl: unaltered. NaOH: dark blue precipitate. H_2SO_4: greenish-blue solution, unaltered and then blue solution on dilution. Light: 3–4. Dyes cotton mordanted with tannin and tartar emetic bright indigo blue, very fast to light, washing, acids and alkalies. Used also in dyeing silk and in calico printing (cF, No. 135).	
Janus Grey B, BB, (MLB) Safranine-azo-dyes— No. 137 (128)	A black powder. H_2O: violet to blue solutions. Alcohol: greenish-blue to blue solutions. HCl to aqueous solution: reddish-violet solution. NaOH: violet precipitate. H_2SO_4: blackish-green solution, blue solution and then reddish-violet solution on dilution. Dyes cotton and artificial silk mordanted with tannin and tartar emetic reddish-blue (*Janus Grey B*) and greyish-blue (*Janus Grey BB*). Unions are dyed from an acid bath.	
Metanil Yellow Y, conc., extra, I, E, PL, (A) (B) (GrE) (BDC) (DH) (Gy) (S) (A) (B) (C) (GrE) (K) (Gy)	The sodium salt is a brownish-yellow powder and is poisonous. The free acid is soluble in ether. In water: partial absorption in blue and violet; on adding acid, bands at $\lambda = 534$.	

(S) (B) Orange MNO, MN, (SCI) (SCI) Tropaeolin G (C) Victoria Yellow O, (MLB) Sodium salt of *m*-sulpho-benzene-azo-diphenylamine. No. 138 (134)	H_2O: orange-yellow solution. Alcohol: orange-yellow solution; moderately soluble in ether and benzene. HCl to aqueous solution: magenta-red solution and precipitate. NaOH: unaltered; separation of yellow plates with excess. H_2SO_4: violet solution; magenta-red solution and precipitate on dilution. Dyes wool and silk from an acid bath, or wool, from a neutral bath, orange-yellow. Level-dyeing 2; relation to cotton 4–3; relation to silk 4. Light: 3. Used mainly for dyeing wool; also for carpet printing and dyeing silk, for colouring paper and for the manufacture of lakes. Discharged white by hydrosulphite on silk, but the white is not perfect on wool.	One of the most important colours for paper. Quantitatively precipitated by $BaCl_2$ + $Al_2(SO_4)_3$.
Brominated Metanil Yellow, (StD) Sodium salt of brominated *m*-sulphobenzene-azo-diphenylamine. No. 139 (135)	A dull yellow powder. H_2O: orange-yellow solution. HCl: violet precipitate. NaOH: yellow solution. H_2SO_4: violet solution, violet precipitate on dilution. Dyes wool orange-yellow from an acid bath. Used also for dyeing cotton and **for colouring paper.**	
Acid Yellow 2G, (GrE) Metanil Yellow S, (GrE) Sodium salt of a sulphonic acid of *m*-sulphobenzene-azo-diphenylamine. No. 140 (136)	A brownish-yellow powder. H_2O: orange-yellow solution. HCl: brownish-yellow precipitate. NaOH: darker solution. H_2SO_4: violet-red solution; yellow-brown solution and precipitate on dilution. Dyes wool yellow from an acid bath. The dyed shade is greener and more resistant to acids than that of Metanil Yellow (No. 138) and is moderatly fast to light and milling.	
Phenoflavine (GrE) Sodium salt of *m*-sulphobenzene-azo-*m*-amino-phenol-*p*-sulphonic acid. No. 141.	A brownish-yellow powder. H_2O: yellow solution. HCl: orange solution. NaOH: orange solution. H_2SO_4: yellow solution, unaltered on dilution. Dyes wool yellow from an acid bath.	Scarcely used.
Orange III (DH) (tM) Methyl Orange MP, (BDC) (A) (A) Golden Orange MP, (A) Helianthine (B) Dimethyl Orange	An orange-yellow powder. In water partial absorption in blue and violet; on adding acid, $\lambda = 539.5$ and $\lambda = 501.6$. H_2O: golden-yellow solution. Alcohol: insoluble. HCl to aqueous solution: magenta-red solution and reddish-brown precipitate. NaOH: orange-yellow soluble precipitate.	

Sodium salt of *p*-sulphobenzene-azo-dimethylaniline. No. 142 (138)	H_2SO_4: brown solution, magenta-red solution on dilution. HNO_3: red, decomp. Dyes wool and silk orange from an acid bath. Too sensitive to acids and too fugitive to light and milling to be used in dyeing. Used as an *indicator in alkalimetry*, as it is not reddened by carbonic acid.	
Orange IV, N, N IV, (BDC) (H) (DH) (Gy) (B) (BK) (By) (C) (K) (L) (tM) (SCI) (B) (MLB) Citronine R V double (BDC) (DH) Acid Yellow D, D extra, DMP, (A) cryst. (C) New Yellow (By) Tropaeoline OO (C) Sodium salt of *p*-sulphobenzene-azo-diphenylamine. No. 143 (139)	An orange-yellow powder or orange-yellow crystalline plates. Mostly potassium salts. In water partial absorption in blue and violet; on adding acid, bands at $\lambda = 537 \cdot 5$. H_2O: orange-yellow solution. On cooling a hot aqueous solution, the dye crystallises in orange spangles. Alcohol: orange-yellow solution; less soluble in ether, insoluble in benzene. HCl to aqueous solution: violet precipitate. NaOH: yellow precipitate. H_2SO_4: violet solution, violet precipitate on dilution. HNO_3: violet. Dyes wool, silk and unions orange-yellow from an acid bath and possesses considerable tinctorial power. Level-dyeing 2; relation to cotton 3–4; relation to silk 4–3. Light: 3–4. Used largely for dyeing wool and silk, and for **compound shades.**	The best yellow for ordinary wool black mixtures.
Curcumine (AAP) (Gy) Yellow WR, (SCI) Brilliant Yellow S, (B) (tM) Sodium salt of a sulphonic acid of *p*-sulphobenzene-azo-diphenyl-amine. No. 144 (142)	An orange-yellow powder. H_2O: yellow solution. Alcohol: insoluble. HCl to aqueous solution: violet-red solution. NaOH: unchanged; violet-red solution with excess. H_2SO_4: bluish-red solution; magenta-red solution on dilution. HNO_3: violet. Dyes wool and silk from an acid bath level yellow, greener and more resistant to acids, light and milling than Orange IV (No. 143).	*Not used.*
Indian Yellow R (H) (By) (C) **Citronine** **Y conc. (BDC)** **Citronine** OOO (S) (SCI) (GrE) Jasmine SF conc. (Gy) (Gy) Azoflavine RS, 3R conc. (MC) (B) (tM) Curcumeine extra (A) Sodium salt of a mixture of three mononitro derivatives of	A dark yellow-brown powder. H_2O: almost completely soluble hot, and dinitrodiphenylamine crystallises on cooling. Alcohol: yellow-brown solution. HCl to aqueous solution: magenta-red solution, and black-brown precipitate. NaOH: yellowish-brown solution, brown precipitate with excess. H_2SO_4: reddish-violet solution, brownish-yellow to olive-brown precipitate on dilution. HNO_3: red. Dyes wool and silk from an acid bath, or wool from a neutral bath, golden-yellow, fast to dilute acids. The presence of nitroso-compounds in	

Orange IV (No. 143) and two dinitro-diphenyl-amines (Juillard). No. 145 (140)	impure brands of these colouring matters exerts a destructive action on animal fibres. Used largely for dyeing leather, and also used for printing wool and silk. The best yellow for silk mordanted with $Sn + SiO_2$. Discharged white by hydrosulphite on wool and silk but the white easily turns brown.	
Indian Yellow G, (S) (S) (By) (C) Azo Yellow I (SCI) Citronine Y conc. (BDC) Azo Yellow O, (S) (K) (SCI) (MLB) Helianthine G, GFF, (Gy), (Gy) Azoflavine SGR, (MC) (B) Azo Acid Yellow (A) Sodium salt of a mixture of two dinitro-derivatives of Orange IV with a little of a trinitro-derivative of Orange IV, two dinitro-diphenyl-amines and a trinitro-diphenyl-amine (Juillard). No. 146 (141)	A reddish-brown powder. In alcohol partial absorption in blue and violet; on addition of potassium hydroxide, bands at $\lambda = 577$. H_2O: lemon-yellow solution hot, and the nitrodiphenylamines crystallise on cooling. Alcohol: yellow solution; practically insoluble in benzene and ether. HCl to aqueous solution: brown solution and brown precipitate. NaOH: yellow-brown solution and then brownish-yellow precipitate. H_2SO_4: magenta-red solution; yellowish-red solution and then yellowish-brown precipitate on dilution. HNO_3: blue-red. Dyes wool and silk from an acid bath, or wool from a neutral bath, yellow. The presence of nitroso-compounds in impure brands of these colouring matters exerts a destructive action on animal fibres. Level-dyeing 2: relation to cotton 4; relation to silk 4. Light: 3–4. Used largely for dyeing leather and also used for printing wool, and silk. Discharged white by hydrosulphite on wool and silk.	See 145.
Azo Flavine FF, H, (B) (MLB) Indian Yellow FF (C) Sodium salt of *p*-sulphobenzene-azo-dinitro-diphenyl-amine. No. 147.	An orange-brown powder. H_2O: orange-yellow solution. HCl: orange-brown precipitate. NaOH: dark brown solution. H_2SO_4: bluish-red solution; red solution and then orange solution and orange precipitate on dilution. HNO_3: red. Dyes wool and silk from an acid bath, or wool from a neutral bath, golden-yellow, fast to acids.	Scarcely used.
Chrysoine G, (DH) (Gy) (SCI) (B) (MLB) Resorcine Yellow (H) (A) (K) (tM) Phosphine Substitute (BDC) Gold Yellow (By) Tropaeoline	A brown powder. In water, partial absorption in blue and violet. H_2O: reddish-yellow solution. HCl: unaltered. NaOH: reddish-brown solution. H_2SO_4: yellow solution; reddish-yellow solution on dilution. HNO_3: yellow. Dyes wool and silk reddish-yellow from an acid bath.	

O, (C) Sodium salt of *p*-sulphobenzene-azo-resorcinol. (No. 148 (143)	Level-dyeing 2; relation to cotton 3–4; relation to silk 3–2. Used mainly for dyeing silk, and also used for dyeing leather.	
New Fast Yellow R (B) Sodium salt of *p*-sulphobenzene-azo-chloro-*m*-phenylenediamine-sulphonic acid. No. 149.	A brick-red powder. H_2O: yellowish-brown solution. HCl: darker solution. NaOH: yellow solution. H_2SO_4: magenta solution; bluish-red solution and then yellowish-brown solution on dilution. Dyes wool yellow from an acid bath.	Not used.
Orange I, I, certified, (DH) (K) 3 (B) B, (L) Tropaeoline OOO No. 1, G (S) α-Naphthol Orange A Sodium salt of *p*-sulphobenzene-azo-α-naphthol. No. 150 (144)	A reddish-brown powder. In water: $\lambda = 483$; on adding ammonia $\lambda = 514.5$ H_2O: orange-red solution. Alcohol: orange solution. HCl to aqueous solution: brown precipitate. NaOH: cherry-red solution. H_2SO_4: violet red solution, red-brown precipitate on dilution. HNO_3: red. Dyes wool and silk from an acid bath orange, moderately fast to light, less fast to milling and rubbing. Considerable tinctorial power, but is now little used, as it is very sensitive to acids and alkalies. Used also for colouring foodstuffs. Officially permitted for this purpose in the United States and Australia. Excellent leather colour.	
Orange II G, IIP, IIPL, IIB, (DH) (Gy) (S) (SCI) (B) (C) (K) (tM) (BDC) (H) (B) (By) Acid Orange II A, (Gy) Beta-Naphthol Orange Sodium salt of *p*-sulphobenzene-azo-β-naphthol. No. 151 (145)	A bright orange powder. In water: $\lambda = 516$ and $\lambda = 484.4$. H_2O: reddish-yellow solution. Alcohol: orange solution. HCl to aqueous solution: brownish-yellow precipitate. NaOH: dark brown solution. H_2SO_4: magenta-red solution, brownish-yellow precipitate on dilution. HNO_3: purple then orange. Dyes wool and silk from an acid bath, or wool from a neutral bath, orange. Level-dyeing 2; relation to cotton 3; relation to silk 4. Light: 3. Used very largely for dyeing wool and silk, owing to its brilliance and level-dyeing properties; also for dyeing leather, jute, and paper; for printing wool and silk; and for the manufacture of lakes. Discharged white by hydrosulphite on wool and silk.	The most important orange for wool. Little used for silk. No affinity for Sn + SiO_2 mordant.
Narceine (DH) Sodium bisulphite compound of *p*-sulpho-	An orange-yellow powder. H_2O: yellow solution. HCl: unaltered. NaOH: brownish-red solution. H_2SO_4: yellow-brown solution; evolution of sulphur dioxide on dilution and warming. HNO_3: yellow-brown.	

benzene-azo-β-naphthol. No. 152.	Used formerly in calico printing.	No longer upon the market.
Fast Fuchsine G (Sch) Azo Fuchsine G (By) Sodium salt of *p*-sulphobenzene-azo-1:8-dihydroxynaphthalene-4-sulphonic acid. No. 153 (146)	A reddish-brown powder. In water: $\lambda = 520.4$. F: W: 516,5 A: 531,5 H_2O: bluish-red solution. HCl: yellower solution. NaOH: bluer solution. H_2SO_4: violet solution; bluish-red solution on dilution. Dyes wool from an acid bath level magenta-red, fast to light and acids, and moderately fast to alkalies. The shade is converted into black of good fastness to stoving and moderate fastness to milling by after-treatment with chromium or aluminium salts. Light: 3.	Little used, Sorbin red being used instead.
Azo Fuchsine GN extra, S, 6B (By) No. 154 (147)	*Azo Fuchsine 6B*— A reddish-brown powder. W: 518,0 A: 570,0|529,0 H_2O: bluish-red solution. Alcohol: sparingly soluble with a bluish-red colour. HCl to aqueous solution: unaltered. NaOH: yellower solution. H_2SO_4: deep red solution; bluish-red solution on dilution. HNO_3: orange-red sol. Dyes wool from an acid bath level magenta-red, fast to acids and of good fastness to stoving. *Azo Fuchsine S* is of good fastness to light. *Azo Fuchsine SH:* Spectrum F: W: 508,0 A: 530,0|655,0	
Quinazol Yellow (B) Sodium salt of *p*-sulphobenzene-azo-dihydroxy-quinoline. No. 155.	Used formerly for colouring paper.	No longer upon the market.
Permanent Orange R paste (A) 2-Sulpho-5-chlorobenzene-azo-β-naphthol. No. 156 (131)	An orange paste. H_2O: insoluble. NaOH: red-brown solution. H_2SO_4: (dry powder) bluish-red solution, reddish-brown precipitate on dilution. HNO_3: red sol. Used for the manufacture of moderately bright orange lakes, fast to water, and oil, and of excellent fastness to light. Light: 1–2.	
Eriochrome Phosphine R (Gy) Sodium salt of *o*-sul-	An orange powder. H_2O: orange-yellow solution. Alcohol: orange solution. HCl to aqueous solution: lighter solution. NaOH:	A better colour than ordinary phosphine.

pho-*p*-nitro-benzene-azo-salicylic acid. No. 157 (133)	bluish-red solution. H_2SO_4: yellowish-orange solution; yellow solution and pale yellow precipitate on dilution. Light: 1–2. Dyes wool from an acid bath very level yellowish-orange, converted by afterchroming into reddish-orange, fast to light, milling and potting, but not fast to carbonising or stoving; also chrome-mordanted wool, or wool from a single bath with metachrome mordant.	
Monolite Red P (BDC) Lake Red P, P paste (MLB) *o*-Sulpho-*p*-nitrobenzene-azo-*β*-naphthol. No. 158 (132)	A yellowish-red paste. H_2O: sparingly soluble, with an orange-red colour on boiling. HCl: bluish-red precipitate. NaOH: bluish-black solution. H_2SO_4: cherry-red solution, red precipitate on dilution. HNO_3: red. Used with barium or calcium for the manufacture of vivid yellowish-red lakes which are largely used on account of their covering power, great fastness to light and good fastness to water, spirit and oil. The lakes are prepared cold, as the shade is impaired by heating.	One of the best lake-reds.
Fast Orange O (MLB) Sodium salt of *p*-sulpho-*o*-nitro-benzene-azo-*β*-naphthol. No. 159 (148)	An orange powder. H_2O: orange solution on heating. Used with calcium or barium for the manufacture of orange lakes which are much yellower and rather less fast to light than is the case with the isomeride, *Lake Red P* (No. 158). Light: 2–3. Moderately fast to water.	
Hansarubin (MLB) G, (MLB) 2-Sulpho-4:6-dinitrobenzene-azo-*β*-hydroxynaphthoic acid. No. 160	A dark red powder or paste. H_2O: sparingly soluble. Alcohol: sparingly soluble. Benzene: insoluble. H_2SO_4: bluish-red solution, red precipitate on dilution. HNO_3: yellow-red sol. Used for the manufacture of clear bluish-red lakes of good covering power, fast to light and oil, for use in printing.	
Orange T, R, (DH) (SCI) (B) (C) (K) (tM) Mandarin GR (A) Sodium salt of *p*-sulpho-*o*-toluene-azo-*β*-naphthol. No. 161 (151)	A brick-red powder. H_2O: reddish-yellow solution. HCl: yellowish-brown flocculent precipitate. NaOH: reddish-brown solution. H_2SO_4: magenta-red solution, yellowish-brown flocculent precipitate on dilution. HNO_3: red sol. Dyes wool and silk orange from an acid bath. The shade is somewhat redder than that of Orange II (No. 151). Used—for dyeing wool and silk; also for dyeing leather, jute and paper; for printing wool and silk; and for the manufacture of lakes.	Scarcely used.

Fast Yellow (tM) Curcumeine Sodium salt of *m*-sulpho-*p*-toluene-azo-diphenylamine. No. 162 (150)	An orange powder. H_2O: yellow solution. HCl: steel-blue precipitate. H_2SO_4: bluish-green solution, steel-blue precipitate on dilution. Dyes wool orange-yellow from an acid bath.	Not used.
Permanent Red 4B, 4B paste, 4B extra pdr. (A) Lithol Rubin B (B) Pigment Rubin R (MLB) Sodium salt of *o*-sulpho-*p*-toluene-azo-β-hydroxynaphthoic acid. No. 163 (152)	A yellowish-red paste or bright red powder. H_2O: yellowish-red solution hot. Alcohol: insoluble. HCl to aqueous solution: brownish-red precipitate. NaOH: brown solution. H_2SO_4: magenta-red solution, magenta-red precipitate on dilution. Light: 1–2. Used with calcium for the manufacture of vivid ruby-red lakes which possess good fastness to light, water, spirit, oil and lime, and are resistant to heat. The tendency of the lakes to turn bronze is characteristic of this colour.	
Orange R, RR, (LDC) (SCI) Sodium salt of sulpho-xylene-azo-β-naphthol. No. 164.	A bright red powder. H_2O: orange-yellow solution. HCl: brownish-red precipitate. NaOH: brownish-yellow solution. H_2SO_4: cherry-red solution, brown precipitate on dilution. Dyes wool from an acid bath level orange of good fastness to carbonising, but not so fast to light as Orange II (No. 151). The shade bleeds when the fabric is left in a wet state. Light: 3. Used also for dyeing silk, and for the manufacture of lakes.	
Red for Lake C (AAP) Lake Red C, NC, C paste (MLB) 6-Sulpho-4-chloro-3-toluene-azo-β-naphthol. No. 165 (153)	An orange-coloured paste. H_2O: sparingly soluble, with an orange colour. HCl: red precipitate. NaOH: brick-red precipitate. H_2SO_4: cherry-red solution, dark brown-red precipitate on dilution. Used for the manufacture of red barium lakes of good fastness.	
Lithol Red 2G, 3B (B) Sodium salt of 6-sulpho-4-chloro-3-toluene-azo-β-hydroxynaphthoic acid. No. 166	The sodium salt forms a red powder. H_2O: yellowish-red solution. Alcohol: insoluble. HCl to aqueous solution: dark red precipitate. Used for the manufacture of bright red lakes of good fastness to light. The shade is bluer and faster than No 165. Light: 2.	
Acid Alizarine Brown B, (Br) (MLB) Chrome Fast Brown BC, (SCI) Palatine Chrome Brown W, (B)	A blackish-brown powder with a green cast. H_2O: brown solution hot. HCl: reddish-yellow solution. NaOH: redder solution. H_2SO_4: dark orange-brown solution; reddish-yellow solution on dilution.	

Anthracene Chrome Brown D (C) Sodium salt of 5-sulpho-2-hydroxybenzene-azo-*m*-phenylene-diamine. No. 167 (154)	Dyes wool from an acid bath and after-chromed brown. Level-dyeing 2; relation to cotton 4; relation to silk 3. Light: 2–3.	
Acid Alizarine Garnet R (MLB) Anthracene Chrome Red A (C) Sodium salt of 5-sulpho-2-hydroxy-benzene-azo-resorcinol. No. 168 (155)	A brick-red powder. H_2O: brownish orange-red solution. HCl: unaltered. NaOH: bright orange-red solution. H_2SO_4: orange-brown solution, unaltered on dilution. HNO_3: orange; decomp. Dyes wool from an acid bath brown, converted into Bordeaux red by after-chroming. Level-dyeing 1–2; relation to cotton 1–2; relation to silk 2–3. Light: 2.	
Solochrome violet R (BDC) Chrome Fast Violet B (SCI) Ortho Cerise B (A) Palatine Chrome Violet (B) Chrome Fast Violet R (A) Anthracene Chrome Violet B, (C) Acid Alizarine Violet N (MLB) Sodium salt of 5-sulpho-2-hydroxy-benzene-azo-β-naphthol. No. 169 (156)	A dark brown powder. H_2O: dark Bordeaux-red solution. Alcohol: yellowish-red solution. HCl to aqueous solution: brown precipitate. NaOH: brown solution. H_2SO_4: magenta-red solution, brown precipitate on dilution. HNO_3: brown-violet. Dyes wool from an acid bath and after-chromed violet; or wool from an acid bath and after-treated with copper sulphate (Copper Red N.). Chrome-level-dyeing 3; relation to cotton 1–2; relation to silk 2. Copper-level-dyeing 3; relation to cotton 3–4; relation to silk 2.	The cheapest chrome violet.
Diamond Black PV (By) Solochrome Black PV (BDC) Chrome Black PV (StD) Sodium salt of 5-sulpho-2-hydroxy-benzene-azo-1:5-dihydroxynaphthalene. No. 170 (157)	A dark brown powder. H_2O: cherry-red solution. HCl: more violet solution. NaOH: red solution. H_2SO_4: brownish-violet solution; bluish-red solution on dilution. HNO_3: brown. Dyes wool from an acid bath and after-chromed, or chrome-mordanted wool, black to blue-black, fast to light, milling, potting and stoving. Sensitive to copper and iron.	Important. Disadvantage: Much Cr is used for developing the black.
Chrome Brown RR (Gy) Sodium salt of 3:5-disulpho-4-hydroxy-benzene-azo-pyrogallol. No. 171 (158)	A dark brown powder. H_2O: yellow solution. Alcohol: insoluble. HCl to aqueous solution: unaltered. NaOH: reddish-brown solution. H_2SO_4: brown solution; brownish-yellow solution on dilution.	

	Dyes chrome-mordanted wool brown and chrome-mordanted cotton reddish-brown. Light: 2–3. Used for dyeing wool and in calico printing.	
Acid Alizarine Black R (S) (MLB) Alizarine Black F (T) Vigoureux Black I (MLB) Sodium salt of 5-sulpho-3-nitro-2-hydroxy-benzene-azo-β-naphthol. No. 172 (159)	A brown-bronze glistening powder. H_2O: violet solution. Alcohol: sparingly soluble with a bluish-violet colour. HCl to aqueous solution: red precipitate. NaOH: dull red precipitate. H_2SO_4: reddish-violet solution; violet solution and then brick-red precipitate on dilution. HNO_3: violet. Dyes wool from an acid bath and after-chromed deep black. Light: 1–2. Level-dyeing 3–2; relation to cotton 1–2; relation to silk 3–4.	
Metachrome Violet B paste (Br) (A) Sodium salt of sulpho-2-hydroxy-5-methyl-benzene-azo-β-naphthol. No. 173	A reddish-violet paste. H_2O: soluble hot. HCl: brown precipitate. NaOH: unaltered. H_2SO_4: reddish-brown solution, brown precipitate on dilution. Dyes wool in a single bath with metachrome mordant reddish-violet of excellent fastness to light, alkalies, washing and milling. Light: 1–2.	
Cheshire Chrome Violet B pdr. (Br) Sodium salt of 4-sulpho-a-naphthalene-azo-p-cresol. No. 174.	A yellowish-brown powder. H_2O: soluble. HCl: unaltered. NaOH: crimson solution. H_2SO_4: dull reddish-violet solution; yellow solution on dilution. HNO_3: brown-violet. Dyes wool from an acid bath and after-chromed violet of excellent fastness to light, alkalies, washing, milling and potting. Light: 2.	Not used.
Acid Brown R (BDC) Fast Brown M, N, G, (Br) (B) Naphthylamine Brown (B) Chrome Brown RO (MLB) Sodium salt of 4-sulpho-α-naphthalene-azo-α-naphthol. No. 175 (160)	A dark brown powder. H_2O: yellowish-brown solution. Alcohol: orange-red solution. HCl to aqueous solution: magenta-red solution and brown precipitate. NaOH: violet-brown solution. H_2SO_4: violet solution; magenta-red solution and then brownish-red precipitate on dilution. Dyes wool from an acid bath brownish-orange, converted into brown by after-chroming. Level-dyeing 4; relation to cotton 2–3; relation to silk 3. Light: 3. Used also for dyeing silk.	Good brown; also for leather.
Fast Red **AV, A extra, A, (BDC)** (A) (B) By) (GrE) (K) (tM) **Roccelline**	A brownish-red powder. In water: $\lambda = \underline{500,9}$ 504.5. In alcohol: $\lambda = 502,9$ H_2O: sparingly soluble cold, red solution hot.	**The most important Azo-red.**

(S) (SCI) (Gy) (tM) (DH) Cardinal Red J (BDC) **Fast Red O,** E, AV (B) (By) (MLB) Sodium salt of 4-sulpho-α-naphthalene-azo-β-naphthol. No. 176 (161)	Alcohol: red solution. HCl to aqueous solution: yellowish-brown precipitate. NaOH: duller and darker solution. H_2SO_4: violet solution, yellowish-brown precipitate on dilution. HNO_3: brown-violet. Dyes wool and silk from an acid bath, or wool from a neutral bath red. Level-dyeing 4; relation to cotton 4–3; relation to silk 4. Light: 2–3. Used also for dyeing unions, jute and paper, and for printing wool.	
Brilliant Fast Red G (B) Roccelline (CD) Sodium salt of 5-sulpho-α-naphthalene-azo-β-naphthol. No. 177 (162)	A brownish-red powder. W: 501,5 A: 502,0 H_2O: sparingly soluble cold, ruby-red solution hot, yellower than No. 176. HCl: brown precipitate. NaOH: yellower solution. H_2SO_4: violet solution; red solution and then brown precipitate on dilution. Dyes wool and silk moderately level red from an acid bath. Light 2–3.	Same properties as 176. Often used in mixtures.
Cuba Orange (FA) Sodium salt of 4-suldho-α-naphthalene-azo-α-naphthalene-4-sulphonic acid. No. 178.	A reddish-yellow powder. H_2O: orange solution hot. Alcohol: almost insoluble. HCl to aqueous solution: orange solution. NaOH: yellow crystalline precipitate. H_2SO_4: blue solution; orange solution and yellowish precipitate on dilution. Dyes wool orange from an acid bath.	Not used.
Fast Red G (B) Carmoisine B, (S) (H) (By) Cardinal 3B (BDC) **Azorubine** A, G, (SCI) (C) (tM) Eriorubine 2B (Gy) Omega Chrome Blue A, B, R, FB, (S) *Chrome Blue* 2R, R, (B) *Azo Chrome Blue* R, (K) Chromotrope FB (M) Sodium salt of 4-sulpho-α-naphthalene-azo-α-naphthol-4-sulphonic acid. No. 179 (163)	A reddish-brown powder. F: W: 517,5 A: 523,5 | 563,5 | 497,0 | In water: $\lambda = 518.5$. H_2O: magenta-red solution. HCl: reddish-brown gelatinous precipitate. NaOH: yellower solution. H_2SO_4: violet solution; magenta-red solution and then reddish-brown precipitate on dilution. Dyes wool from an acid bath red, converted into violet-blue by after-chroming. The latter shade appears red in artificial light. Light: 2–3; Chrome lake 2. Level-dyeing 3–4; relation to cotton 1–2; relation to silk 1. Used for compound shades as a substitute for Acid Magenta, as it possesses better fastness properties than the latter; also for printing wool and silk. Discharged white by hydrosulphite on wool and silk.	Excellent red! Not good as Cr-colour because too much CrO_3 has to be used.
Fast Red VR (By) *Carmoisine* L 9156 K (BDC) For after-chrome dyeing.	A reddish-brown powder. W: 530,5, 593,5 (571,5?) A: 528,5 570,5, 492,7 H_2O: bluish-red solution. HCl: reddish-brown precipitate. NaOH: unaltered.	Little used. (See 179.)

Chrome Fast Blue R (SCI) Chromotrope F4B Diamond Blue 3B (By) Azochrom—*blue* B (K) Sodium salt of 4-sulpho-α-naphthalene-azo-α-naphthol-5-sulphonic acid. No. 180 (164)	H_2SO_4: reddish-blue solution, reddish-brown precipitate on dilution. Dyes wool from an acid bath bluish-red, converted into navy blue by after-chroming. The latter shade appears red in artificial light. Light: 2–3. Level-dyeing 3–4; relation to cotton 1; relation to silk 2.	
Azo Red A (C) Sodium salt of 4-sulpho-α-naphthalene-azo-α-naphthol-3:6-disulphonic acid. No. 181 (165)	A brown powder. H_2O: red solution. HCl: unaltered. NaOH: yellower solution. H_2SO_4: blue solution; violet solution and then red solution on dilution. Dyes wool from an acid bath bright crimson-red, fast to acids, alkalies and stoving, and moderately fast to light and washing. Light: 3–4. Used for compound shades in dyeing unions.	
Fast Red E, (B) (By) (GrE) (tM) (BDC) (K) Fast Red S (DH) (MLB) (A) Naphthol Red GR, EB, (B) (C) Sodium salt of 4-sulpho-α-naphthalene-azo-β-naphthol-6-sulphonic acid. No. 182 (166)	A red-brown powder. F: W: 498,0 A: 502,0 In water: $\lambda = 504.5$. H_2O: Bordeaux-red solution. Alcohol: moderately soluble. HCl to aqueous solution: unaltered or rather darker solution. NaOH: brownish-red solution. H_2SO_4: violet solution; red solution on dilution. Dyes wool red from an acid bath. Level-dyeing 4; relation to cotton 2–3; relation to silk 3. Light: 3.	Little used.
Scarlet 000 (H) Croceine Scarlet 3BX (By) Coccin—2B (A) Sodium salt of 4-sulpho-α-naphthalene-azo-β-naphthol-8-sulphonic acid. No. 183 (167)	A scarlet-red powder. H_2O: yellowish-red solution. Alcohol: insoluble. HCl to aqueous solution: unaltered. NaOH: yellowish-brown solution. H_2SO_4: reddish-violet solution; yellowish red solution on dilution. HNO_3: yellow-red. Dyes wool and silk from an acid bath moderately level red, of good fastness to light, alkalies and acids, moderately fast to ironing and dry-steaming, but not fast to stoving or milling. Light: 2–3. Used also for printing wool and silk, and for dyeing leather.	
Amaranth (MLy) (MLB) (tM) (StD) (C) (M) Brilliant Bordeaux (LBH) Azorubine	A reddish-brown powder. F. In water: $\lambda = 522.5$. F. *Azorubine:* A: 517,5 A: 523,5|563,5 497,0 H_2O: magenta-red solution.	

S (S) Naphthylamine Red, S, 3BM (By) (B) Naphthol-*red* S, C, O (B) (M) (C) Sodium salt of 4-sulpho-α-naphthalene-azo-β-naphthol-3:6-disulphonic acid. No. 184 (168)	Alcohol: sparingly soluble. HCl to aqueous solution: unaltered. NaOH: darker solution. H_2SO_4: violet solution; bluish-violet solution and then magenta-red solution on dilution. Dyes wool and silk bright bluish-red from an acid bath. Level-dyeing 4; relation to cotton 1; relation to silk 2. Light: 3–4. Used also for printing wool and silk, and for **colouring foodstuffs.** Officially permitted for the latter purpose in the United States and Australia. Discharged white by hydrosulphite on wool and silk.	
Scarlet 00000 (H) (BDC) Brilliant Ponceau 5R, 4R (By) (By) (StD) Cocchenillerot A (B) Sodium salt of 4-sulpho-α-naphthalene-azo-β-naphthol-6:8-disulphonic acid. No. 185 (169)	A scarlet-red powder. *Brilliant Ponceau* 4R:F:W:502,0|542,0 A: 505,5|444,0 5R: F: W: 501,0 A: 544,0|(495,0) H_2O: scarlet-red solution. *Cocchenillerot A* F: W: 500,0 A: 500,5|540,0 HCl: unaltered. NaOH: brown solution. H_2SO_4: magenta-red solution; yellowish-red solution on dilution. Dyes wool and silk bright scarlet-red from an acid bath. Level-dyeing 4; relation to cotton 2; relation to silk 1–2. Light: 3. Used also for printing wool. Discharged white by hydrosulphite NF on wool.	
Ponceau 6R (MLB) (B) Scarlet 6R Sodium salt of 4-sulpho-α-naphthalene-azo-β-naphthol-3:6:8-trisulphonic acid. No. 186 (170)	A brown powder. λ in W: 517,0 A: insoluble. In water: about λ = 512.0. H_2O: magenta-red solution. Alcohol: sparingly-soluble with a bluish-red colour. HCl to aqueous solution: unaltered. NaOH: reddish-brown solution. H_2SO_4: bluish-violet solution; magenta-red solution on dilution. Dyes wool red from an acid bath. Level-dyeing 4; relation to cotton 1; relation to silk 2. Used also for dyeing silk.	
Roxamine (DH) Sodium salt of 4-sulpho-α-naphthalene-azo-2:7-dihydroxy-naphthalene. No. 187.	A brick-red powder. N: 492,5, A: 497,5 H_2O: scarlet solution. HCl: unaltered. NaOH: darker solution. H_2SO_4: intense violet solution; scarlet solution on dilution. Dyes wool and silk from an acid bath red of moderate fastness. Light: 3–4. Used formerly as a substitute for Archil.	No longer upon the market. Not used.

Chromotrope 8B (MLB) Sodium salt of 4-sulpho-α-naphthalene-azo-1:8-dihydroxy-naphthalene-3:6-disulphonic acid. No. 188 (171)	A greyish-violet powder. W: 537,0|577,0 A: 542,5|585,5 H_2O: violet-red solution. Alcohol: very sparingly soluble, with a violet colour. HCl to aqueous solution: bluer solution. NaOH: darker solution. H_2SO_4: indigo-blue solution; violet soluti n on dilution. Dyes wool from an acid bath reddish-violet, converted into black by after-chroming. Light: 3. Level-dyeing 4; relation to cotton 1; relation to silk 2.	No longer used as chrome blue in Europe.
Signal Red **Lithol Red R** (LDC) Lake Red R, (SAPC) Monolite Red R (BDC) 1-Sulpho-β-naphthalene-azo-β-naphthol. No. 189 (173)	Red powder, lumps or paste. H_2O: insoluble cold, sparingly soluble, with a yellowish red colour, hot. Alcohol: insoluble cold, yellowish-red solution hot. HCl to alcoholic solution: brownish-violet solution. NaOH: unaltered. H_2SO_4: violet solution, dull violet precipitate on dilution. HNO_3: purple. Completely precipitated hot by barium chloride. Used largely for the manufacture of bright bluish-red lakes with good covering power, fast to water and light, and of good fastness to oil and lime. Good resistance to heat as compared with other β-naphthol azo lakes. Light: 2–3.	The cheapest printing red for illustrations. Only barium-lake is bluish-red.
Lake Bordeaux B paste (MLB) 1-Sulpho-β-naphthalene-azo-β-hydroxy-naphthoic acid. No. 190 (179)	A Bordeaux red paste. W: 523,5| 492,5 A: 528,5| 495,0 Used with calcium chloride and Turkey-red oil for the manufacture of bluish-red to dark brownish Bordeaux red lakes, fast to light, spirit and oil, and of good fastness to water. The barium lakes are of a yellower shade. The first pigment colour of this class to be patented; not used to any great extent.	
Pyrotine RRO (WDC) Sodium salt of 5-sulpho-β-naphthalene-azo-α-naphthol-4-sulphonic acid. No. 191.	A brownish-red powder. H_2O: yellowish-red solution. HCl: bluish-red solution. NaOH: yellower-red solution. H_2SO_4: magenta-red solution; red solution on dilution. Dyes wool red from an acid bath. Light: 4–3.	
Fast Brown 3B (Br) (A) Sodium salt of 6-sulpho-β-naphthalene-azo-α-naphthol. No. 192 (172)	A brown powder. H_2O: brownish-red solution. HCl: reddish-violet solution and precipitate. NaOH: magenta-red solution. H_2SO_4: blue solution; reddish-violet solution and then reddish-violet precipitate on dilution. HNO_3: violet solution.	Scarcely used to-day.

	Dyes wool and silk from an acid bath reddish-brown of only moderate fastness. Light: 3–4. Used mainly for dyeing leather and for the manufacture of lakes.	
Double Brilliant Scarlet G GMP (ACC) (tM) A, K Scarlet for Silk (MLB) O, (MLB) Sodium salt of 6-sulpho-β-naphthalene-azo-β-naphthol. No. 193 (174)	A reddish-brown powder. λ: W: 495,5 533,5? A: 495,0| 533,0. H_2O: scarlet solution. HCl: brown precipitate. NaOH: reddish-brown precipitate, soluble in much water. H_2SO_4: magenta-red solution, brownish-red precipitate on dilution. HNO_3: red. Dyes wool and silk from an acid bath yellowish-scarlet, moderately fast to light. Light 3–4.	
Double Brilliant Scarlet S (ACC) Scarlet PR, 2R, 2R extra conc. (StD) Brilliant Double Scarlet, 3R, (By) Brilliant Ponceau 4R (By) Sodium salt of 6-sulpho-β-naphthalene-azo-α-naphthol-4-sulphonic acid. No. 194 (176)	A brownish-red powder. W: 502,0| 542,0 A: 505,5| 444,0. H_2O: yellowish-red solution. HCl: yellowish-brown precipitate. NaOH: unaltered. H_2SO_4: magenta-red solution; scarlet solution and then yellowish-brown precipitate on dilution. Dyes wool and silk from an acid bath pure scarlet, fast to stoving, alkalies and acids, moderately fast to light, but not fast to milling. Light: 3–4.	
Chrome Yellow **Anthracene Chrome Yellow** BN, (ACC) (By) (StD) Mordant Yellow R, O (MLB) (B) Erio Chrome Yellow S (Gy) Salicine Yellow R, O D, Chrome Fast Yellow S S (SCL) Sodium salt of sulpho-β-naphthalene-azo-salicylic acid. No. 195 (177)	A yellow powder. H_2O: yellowish-red solution. HCl: brown solution which deposits a greyish-brown gelatinous precipitate on keeping. NaOH: orange-red solution and precipitate. H_2SO_4: orange-red solution, reddish-grey flocculent precipitate on dilution. HNO_3: yellow-red at first, then decolorised. Dyes wool and silk from an acid bath reddish-yellow converted into olive-yellow by after-chroming. A purer and greener shade is obtained on chrome-mordanted wool or on wool in a single bath with metachrome mordant. Level-dyeing 2–3; relation to cotton 1; relation to silk 1. Light: 1–2. Used also in calico printing with a chromium mordant; also for dyeing chrome-leather; also for the manufacture of lakes with barium chloride.	Best and cheapest yellow fast to potting (wool).
Acid Ponceau DH, (Gy) Ponceau for Silk, (StD) (SCl) Silk Ponceau	A scarlet-red powder. F: are mixtures. H_2O: sparingly soluble cold, yellowish-red solution hot. HCl: brown precipitate. NaOH: browner solution.	

G (K) Sodium salt of 5- and 8-sulpho-β-naphthalene-azo-β-naphthol. No. 196 (175)	H_2SO_4: magenta-red solution, brown precipitate on dilution. Dyes wool and silk from an acid bath red of moderate fastness. Light: 3–4. Discharged white by hydrosulphite on wool and silk.	
Solochrome Yellow Y (BDC) Crumpall Yellow (Lev) Sodium salt of 6:8-disulpho-β-naphthalene-azo-salicylic acid. No. 197 (178)	A yellow powder. H_2O: yellow solution. Alcohol: sparingly soluble. HCl to aqueous solution: orange-red solution. NaOH: greenish-yellow solution. H_2SO_4: orange-red solution, unaltered on dilution. HNO_3: red. Dyes wool or chrome-mordanted wool from an acid bath yellow, of good fastness to light, milling, acids and alkalies. Light: 2–3. Used also in calico printing with a chromium mordant for bright yellow.	Scarcely used.
Heliopurpurine 4BL, (By) Sodium salt of 3:6-disulpho-β-naphthalene-azo-a-naphthol-3:6-disulphonic acid. No. 198.	Used for the manufacture of red lakes, fast to light and lime. Light: 1–2. The aluminium lakes of Nos. 198, 199 and 200 are most suited for the manufacture of lithographic and letter-press inks, whilst the barium lakes are most suited for use in writing inks.	
Heliopurpurine *GL (By)* Sodium salt of 3:6-disulpho-β-naphthalene-azo-β-naphthol-3:6:8-trisulphonic acid. No. 199.	Used for the manufacture of yellowish-red lakes, fast to lime and moderately fast to light (cf. No. 198). Light: 3.	
Heliopurpurine 7BL (By) Sodium salt of 1:6-disulpho-β-naphthalene-azo-β-naphthol-3:6-disulphonic acid. No. 200.	Used for the manufacture of bluish-red lakes fast to light and lime (cf. No. 198). Light: 2.	
Eriochrome Blue-Black **B. Chrome Blue-Black** B (ACC) **Omega Chrome Cyanine** B (S) Sodium salt of 4-sulpho-2-hydroxy-α-naphthalene-azo-α-naphthol. No. 201 (180)	A brownish-black powder. W: <u>532,0</u>|A: <u>501,0</u>|538,5 (592,0) H_2O: blackish-violet solution hot. Alcohol: cherry-red solution. HCl to aqueous solution: reddish-brown, then brownish-black precipitate. NaOH: deep blue, then cherry-red solution. H_2SO_4: dark blue solution, violet-black precipitate on dilution. Dyes wool, from an acid bath dark brownish-violet, converted by afterchroming into deep blue-black of excellent fastness to light, rubbing, stoving, potting, milling, alkalies and perspiration. It is not so fast to	The copper-lake is purple red.

	rubbing and potting on chrome-mordanted wool. Differs from No. 202 in that it does not appear reddish in artificial light. Light: 1–2. Sensitive to iron and slightly sensitive to copper.	
Eriochrome Blue-Black R. Chrome Blue-Black R (ACC) **Metachrome Blue-Black** **Palatine Chrome Black** 6B (B) **Alizarine Blue-Black** A, (MLB) (Gy) **R,** **Omega Chrome Cyanine** R (S) *Blue Dyes* Era Chrome Dark Blue B (BDC) Sodium (or zinc) salt of 4-sulpho-2-hydroxy-α-naphthalene-azo-β-naphthol. No. 202 (181)	A dark brown powder. W: 506,0| A: 535,5|507,0(587,5) H_2O: violet solution. Alcohol: bluish-red solution. HCl to aqueous solution: brown precipitate. NaOH: Bordeaux-red solution. H_2SO_4: blue solution, red precipitate dilution. HNO_3: red. Dyes wool from an acid bath reddish-brown, converted by after-chroming into black of excellent fastness to light, rubbing, stoving, dry-steaming, washing, milling, alkalies and acids, but less fast to potting and more sensitive to copper than No. 201. When dyed and chromed in a single bath, the shade is rather less fast to milling. Light: 1–2. Used particularly for dyeing fast grey on loose wool, and also used for the manufacture of lakes.	The copper-lake is purple-red.
Chrome Black T, (StD) **Eriochrome Black,** T (Gy) **Omega Chrome Black** S, T (S) Solochrome Black T (BDC) Sodium salt of 4-sulpho-5-nitro-2-hydroxy-α-naphthalene-azo-α-naphthol. No. 203 (183)	A brownish-black powder with a faint metallic lustre. H_2O: reddish-brown solution hot. HCl: violet-brown precipitate with excess. NaOH: deep blue, then red solution. H_2SO_4: blackish-blue solution, brown precipitate on dilution. HNO_3: red-olive "indigo test." Dyes wool from an acid bath reddish-black, converted by after-chroming into bluish-black of excellent fastness to light and milling, and of very good fastness to potting. Light: 1–2.	**Best chrome black is fast replacing Diamond Black P. V.**
Eriochrome Black A (GY) Solochrome Black A (BDC) **Chrome Black,** (StD) **Omega Chrome Black PA, (S)** Sodium salt of 4-sulpho-5-nitro-2-hydroxy-α-naphthalene-azo-β-naphthol. No. 204 (184) *Bromo*-Derivative.	A brownish-black powder with a faint metallic lustre. H_2O: dark blue solution. HCl: reddish-brown precipitate. NaOH: cherry-red solution. H_2SO_4: dark violet-blue solution, brown precipitate on dilution. HNO_3: red olive. Dyes wool from an acid bath dark reddish-brown, converted by after-chroming into deep black of excellent fastness to light, rubbing, stoving, milling, alkalies and perspiration, but not quite so fast to potting as No. 201. Light: 1–2. Redder than 203.	

Ponceau 3*R* (*By*) Sodium salt of 8-sulpho-2-hydroxy-α-naphthalene-azo-7-sulphonic acid. No. 205	A red powder. H_2O: magenta solution. λ: 500; 538.7 (in water). Alcohol: magenta solution, hot. HCl to aqueous solution: darker solution. NaOH: brown solution (poured on filter paper, brown spot with a cherry-red rim). H_2SO_4: bluish-red solution; reddish-brown solution on dilution. Dyes wool red from an acid bath. Light: 3.
Anthracene Chrome Black F, FE, 5B, P extra (C) Sodium salt of 6-sulpho-3-hydroxy-β-naphthol. No. 206 (185)	*Anthracene Chrome Black F and FE* are blackish-brown powders and *Anthracene Chrome Black 5B* is a brownish-black powder with a violet tint. H_2O: carmine-red to wine-red solutions. HCl: F bluish-violet solution; FE redder solution; 5B violet solution (or very soluble precipitates). NaOH: bluish-violet solutions or very soluble precipitates. H_2SO_4: F bluish-green solution; FE blue solution; 5B dirty red solution; reddish-violet solutions and then reddish-violet to red-brown precipitates on dilution. Dyes wool from an acid bath dull violet, converted by after-chroming into deep black, fast to light, milling, dry-steaming, stoving, alkalies and acids. Light: 2–1. *Anthracene Chrome Black F* is moderately fast to potting, whereas the 15*B* and *P* brands are fast to potting.
Lanacyl Violet B (C) Pontacyl Sulphon Violet R (DuP) Sodium salt of 3:6-disulpho-8-hydroxy-α-naphthalene-azo-ethyl-α-naphthylamine. No. 207 (186)	A dark brown powder. W: 547,5 A: 564,7. In water: λ = 542. H_2O: reddish-violet solution. HCl: unaltered. NaOH: orange-red solution. H_2SO_4: greenish-blue solution; blue solution and then violet solution on dilution. Dyes wool from an acid bath bluish-violet, fast to light and washing, and moderately fast to milling, acids and alkalies. Light: 2.
Sulphon Acid Blue G, R (By) (RB) S Amidonaphthol Blue R (StD) Tolyl Blue SR Fast Acid Blue RH (BDC) Sodium salt of 3:6-disulpho-8-hydroxy-α-naphthalene-azo-phenyl-α-naphthyl-	A black powder with a reddish tint. G: W: 592,0 A: 604,5 R: W: 569,5 584,5 H_2O: reddish-violet solution. HCl: greenish-blue solution. NaOH: bright red solution. H_2SO_4: dirty blue solution; greenish-blue solution on dilution. HNO_3: olive-yellow. Dyes wool from a Glauber's salt and acetic acid bath which is subsequently exhausted with 1–2% of sulphuric acid blue, fast to light and alkalies.

amine-8-sulphonic acid. No. 208 (188) B = *p*-Tolyl-derivative.	It does not dye level and is extremely sensitive to stoving, which changes the colour to yellow. Light: 1–2. Used mainly for dyeing woollen piece goods.
Sulphon Acid Blue BA, B (By) Amidonaphthol Blue B (StD) Tolyl Blue SB (MLB) Neutrallelan B (Cl) Sodium salt of 3:6-disulpho-8-hydroxy-α-naphthalene-azo-p-tolyl-α-naphthyl-amine-8-sulphonic acid. No. 209 (189)	Not dischargeable by hydrosulphite. A dark indigo-blue powder. Sulphon and Blue B: W: 572,0 A: 584,5 Tolyl Blue SB W: 581,0 A: 593,5 H_2O: reddish-blue solution. HCl: greenish-blue solution and soluble blue precipitate. NaOH: red solution. H_2SO_4: dirty violet solution; greenish-blue solution on dilution. Dyes wool from an acetic acid bath dark blue, fast to acids, alkalies and light, and moderately fast to milling, but does not stain cotton effects. It does not dye level and is extremely sensitive to stoving, which changes the colour to yellow. Light: 2–1. Used mainly for dyeing woollen piece goods. Not dischargeable by hydrosulphite.
Amidonaphthol Blue Black B (StD) *Lanacyl Blue* BB (C) Sodium salt of 3:6-disulpho-8-hydroxy-α-naphthalene-azo-5-amino-1-naphthol. No. 210 (187)	A black powder. W: 578,5 A: insoluble. In water: Lanacyl Blue BB, $\lambda = 572$; Lanacyl Blue R, $\lambda = 552.6$. H_2O: reddish to bluish-violet solution. HCl: little change. NaOH: orange-red solution. H_2SO_4: blue solution, unaltered and then violet solution on dilution. HNO_3: yellow. Dyes wool from an acid or neutral bath dark greenish-blue of good fastness to light and acids. Light: 2. Used for dyeing woollen piece goods, knitting yarns, carpet yarns and unions. Discharged by hydrosulphite. NF.
Methyl Red *o*-Carboxylic acid of benzene-azo-dimethylaniline. No. 211.	Glistening violet needles when crystallised from acetic acid. H_2O: insoluble. Alcohol: moderately soluble. HCl to alcoholic solution: violet-red solution. NaOH: faint yellow solution. Used as an **indicator** in a 0,2% alcoholic solution. It is more sensitive than Methyl Orange (No. 142). See also: Clark: *The Determination of Hydrogen-Ions.* (Baltimore: [1922] Williams, Wilkins & Co.)
Palatine Chrome Bordeaux B (B) Sodium salt of the *o*-	A dark brown powder. H_2O: brownish-yellow solution. HCl: reddish-brown precipitate. NaOH: yellowish-red solution.

carboxylic acid of benzene-azo-*p*-cresol. No. 212.	Dyes wool level reddish-yellow, converted into Bordeaux red by after-chroming. Light: 3.	
Diamond Yellow R paste *o*-Carboxylic acid of benzene-azo-salicylic acid. No. 213.	A brown paste. H_2O: sparingly soluble with a yellow colour, readily soluble in presence of sodium hydroxide or sodium acetate. Alcohol: soluble. H_2SO_4: reddish-yellow solution, brownish-yellow precipitate on dilution. Dyes chrome-mordanted wool, or wool from an acid bath and after-chromed, reddish-yellow, fast to light, milling, alkalies and acids. Light: 2–3.	
Lake Red D, D paste (MLB) *o*-Carboxylic acid of benzene-azo-β-naphthol. No. 214 (200)	Used also in calico printing. An orange-red paste, which crystallises from acetic acid in red needles, M. P. 276°. H_2O: sparingly soluble, with an orange colour on boiling. Alcohol: orange solution hot. HCl to aqueous solution: orange precipitate. NaOH: darker orange solution. H_2SO_4: crimson solution, orange precipitate on dilution. HNO_3: orange. Used for the manufacture of bright yellowish-red lakes fast to alkali, water and spirit, moderately fast to light and oil. Light: 3. The barium lake is a purer and yellower shade than the calcium lake.	
Pigment Scarlet G (MLB) *o*-Carboxylic acid of benzene-azo-β-naphthol-6-sulphonic acid. No. 215 (201)	A red bronzy powder. H_2O: insoluble. NaOH: yellowish-red solution. Used for the manufacture of yellowish-red lakes which are sufficiently fast to light, spirit, water and oil. Light: 2–3.	
Eriochrome Red PEI (Gy) **Palatine Chrome Red** B (B) Acid Alizarine Red B (MLB) **Pigment scarlet 2B** Solochrome Red B (BDC) Sodium salt of the *o*-carboxylic acid of benzene-azo-β-naphthol-3:6-disulphonic acid. No. 216 (202) Pigment scarlet 3B (M) is also the chrome-lake of Eriochrome red B.	A bluish-red powder. W: <u>491,5</u> 524,0 A: <u>525,0</u> <u>591,0</u>. H_2O: yellowish-red solution. Alcohol: insoluble. HCl to aqueous solution: yellowish-brown soluble precipitate. NaOH: brownish-red solution. H_2SO_4: red solution, yellowish-brown precipitate on dilution. (Pigment scarlet.) Dyes wool from an acid bath and after-chromed Bordeaux red. Level-dyeing 2–3; relation to cotton 1; relation to silk 1–2. No use in dyeing. Light: 3–4. Lake (Ba): 1–2. Used largely also for the manufacture of bluish-red lakes of excellent fastness to light, good resistance to heat, and sufficient fastness to water, but very sensitive to acids and alkalies.	**One of the most important lake reds.**

Yellow Fast to Soap (StD) Sodium salt of the *m*-carboxylic acid of benzene-azo-diphenylamine. No. 217 (203)	A brown paste. H_2O: sparingly soluble. Alcohol: soluble. HCl to aqueous solution: reddish-violet solution. NaOH: little change. H_2SO_4: violet solution; magenta-red solution on dilution. Dyes wool reddish-yellow from a bath containing soap. Used also in calico-printing on a chromium mordant for orange shades, fast to washing and moderately fast to light. Light: 3–4.	Scarcely used.
Diamond Yellow G paste (By) *m*-Carboxylic acid of benzene-azo-salicylic acid. No. 218 (204)	A greyish-yellow paste. H_2O: sparingly soluble with a yellow colour, readily soluble in presence of sodium hydroxide or sodium acetate. Alcohol: soluble. HCl to aqueous solution: yellow precipitate. NaOH: yellow precipitate. H_2SO_4: reddish-yellow solution, yellow gelatinous precipitate on dilution. Dyes chrome-mordanted wool greenish-yellow. Light: 4. Used as a substitute for Fustic in wool dyeing and for Persian berries in calico printing.	Scarcely used.
Eriochrome Flavine A (Gy) Sodium salt of azo-salicylic acid. No. 219.	A yellow powder. The free acid separates from ethyl acetate in yellow crystalline powder, M. P. 265°. H_2O: yellow solution. HCl: yellowish-white flocculent precipitate. NaOH: orange solution, precipitate with excess. H_2SO_4: orange solution, yellow precipitate on dilution. Dyes wool from an acid bath and after-chromed level deep yellow, fast to light, milling and potting. Light: 1–2.	Best of all chrome yellows. (Persian carpets.)
Alkali Brown (WDC) *Cotton Brown* R *Benzo Brown* 5R Sodium salt of Primuline-azo-*m*-phenylenediamine. No. 220 (190)	A dark brown powder. H_2O: brownish-red solution. Alcohol: brown solution. HCl to aqueous solution: dark brown precipitate. NaOH: red precipitate. H_2SO_4: bluish-violet solution, dark brown precipitate on dilution. Dyes cotton direct from a neutral or alkaline Glauber's salt bath reddish-brown, moderately fast to light and washing, and not sensitive to acids or alkalies. The fastness to washing is increased by after-treatment with formaldehyde. Light: 4. A satisfactory white discharge cannot be obtained in calico printing by the use of the usual reagents.	Scarcely used.

Pyramine Yellow R (B) Sodium salt of Primuline-azo-nitro-*m*-phenylenediamine. No. 221 (191)	A reddish-brown powder. H_2O: yellowish-brown solution hot. Alcohol: slightly soluble with a yellow colour. HCl to aqueous solution: reddish-brown precipitate. NaOH: unaltered or yellowish-brown precipitate. H_2SO_4: brownish-yellow solution, reddish-brown precipitate on dilution. Dyes cotton direct and wool from a Glauber's salt bath golden-yellow. The shade on wool is fast to carbonising and stoving, and is of good fastness to light and to milling against white wool. Light: 3. A satisfactory white discharge cannot be obtained in calico printing by the use of the usual reagents.	
Cotton Orange G (B) Sodium salt of Primuline-azo-*m*-phenylene-diamine-disulphonic acid. No. 222 (192)	A brown powder. H_2O: orange-yellow solution. Alcohol: insoluble. HCl to aqueous solution: reddish precipitate. NaOH: unaltered. H_2SO_4: brownish-orange solution, reddish precipitate on dilution. Dyes cotton direct from a boiling bath level orange, fast to washing, which can be developed with diazotised *p*-nitroaniline. When dyed on wool and after-chromed, the shade is very fast to milling. Light: 4. Used also for dyeing unions and silk, and in calico printing. Not discharged white by hydrosulphite.	**Not used.**
Cotton Yellow R (B) Direct Fast Yellow BO (PCC) *Oriol Yellow* (Gy) Sodium salt of sulphobenzenylamino-thiocresol-azo-salicylic acid. No. 223 (199)	A red powder. H_2O: orange-yellow solution. HCl: yellow precipitate. NaOH: redder solution or soluble orange-yellow precipitate. H_2SO_4: scarlet-red solution, brownish-yellow precipitate on dilution. HNO_3: red solution. Dyes cotton direct from a boiling Glauber's salt bath yellow, fast to acids, moderately fast to soap, and of good fastness to light. Redder shades, faster to light and washing, are obtained by after-treatment with copper salts. Wool is dyed from a faintly acid bath and after-chromed yellow of very good fastness to milling, but of only moderate fastness to other tests. Light: 3–4. Used also for dyeing uniform shades on unions and in calico-printing in the form of its insoluble chromium lake. A satisfactory white discharge cannot be obtained in calico printing by the use of the usual reagents.	

Clayton Cloth Red *Silk Red* ST (K) Titan Scarlet D (H) Ammonium (or sodium) salt of sulpho-benzenyl-amino-thiocresol-azo-β-naphthol. No. 224 (193)	A dark red powder. H_2O: brownish-red solution. HCl: red precipitate. NaOH: red precipitate. H_2SO_4: violet-red solution, red precipitate on dilution. Dyes cotton direct pink to crimson-red, fast to acids, and wool and silk from an acetic acid bath red, converted by after-chroming into somewhat duller shades, which are faster to light and milling, but are not fast to stoving. Light: 3. Used also for dyeing cotton direct pink. A satisfactory white discharge cannot be obtained in calico printing by the use of the usual reagents.	
Chlorazol Pink Y (BDC) Direct Scarlet 6BX (NCW) Thiazine Red R (B) Rosanol 10B (K) Sodium salt of sulpho-benzenylamino-thio-cresol-azo-α-naphthol-4-sulphonic acid. No. 225 (194)	A dark red powder. W: $\underline{505,0}$ A: $\underline{511,0}$|549,5 H_2O: crimson-red solution. Alcohol: insoluble. HCl to aqueous solution: violet-red precipitate. NaOH: unaltered. H_2SO_4: violet-red solution, violet-red precipitate on dilution. Dyes cotton direct pink to crimson-red, fast to acids, and wool from a faintly acid bath red, fast to carbonising and stoving, moderately fast to milling, and rendered fast to light by after-treatment with copper salts. Light: 3. Used for dyeing cotton, wool and unions. A satisfactory white discharge cannot be obtained in calico printing by the use of the usual reagents.	
Clayton Cloth Scarlet (CAC) Thiazine Red GN (B) Titanosa 3B (H) Sodium salt of sulpho-benzenylamino-thio-cresol-azo-β-naphthol-6-sulphonic acid. No. 226 (196)	A brownish-red powder. H_2O: wine-red solution. HCl: reddish-orange soluble precipitate. NaOH: darker solution. H_2SO_4: crimson-red solution, yellowish-red precipitate on dilution. Dyes cotton direct from a salt bath, or half-silk from a soap bath, pink, of good fastness to washing, alkalies and acids. Wool is dyed from a faintly acid bath scarlet-red, rendered fast to light by after-treatment with copper salts. Light: 3. Used for dyeing cotton, wool, unions and half-silk. A satisfactory white discharge cannot be obtained in calico printing by the use of the usual reagents.	
Direct Fast Scarlet R (PCC) Rosaphenine SG (CAC) Sodium salt of Primuline-azo-α-naphthol-4-sulphonic acid.	A dark red powder. H_2O: crimson solution. Alcohol: insoluble. HCl to aqueous solution: violet-red precipitate. NaOH: unaltered. H_2SO_4: violet-red solution; violet-red precipitate on dilution.	Best dye of this class.

Chicago red (Gy) No. 227 (195)	Dyes cotton direct pink to crimson-red, fast to acids. Light: 2–3. A satisfactory white discharge cannot be obtained in calico printing by the use of the usual reagents.	
Direct Fast Rose 3S Thiazine Red G (B) Sodium salt of Primuline-azo-β-naphthol-6-sulphonic acid. No. 228 (197)	A brownish-red powder. W: 498,5 A: 499,0 543,5? H_2O: orange-red solution. HCl: orange-red precipitate. NaOH: darker solution. H_2SO_4: blood-red solution, orange precipitate on dilution. Dyes cotton direct yellowish-pink to yellowish-red from a salt bath. Used also for dyeing wool, silk and unions. The dyeings on wool are rendered very fast to light by after-treatment with copper sulphate. Light: 2. A satisfactory white discharge cannot be obtained in calico printing by the use of the usual reagents.	
Chrome Fast Yellow G (A) No longer upon the market. Sodium salt of the di- and tri-sulphonic acid of phenotriazine-azo-salicylic acid. No. 229	An orange-yellow powder. H_2O: orange-yellow solution. Alcohol: orange-yellow solution. HCl to aqueous solution: yellow flocculent precipitate. NaOH: unaltered. H_2SO_4: orange-yellow solution, lighter solution on dilution. Dyes chrome-mordanted wool yellow.	

DISAZO DYES

a. **Primary Disazo dyes**

$R \rightarrow A \leftarrow R^{I}$ (Type: Naphthol Blue-black)

No. 230–246

b. **Secondary Disazo dyes**

$R \rightarrow A \rightarrow R^{I}$ (Type: Biebrich Scarlet)

No. 247–325 and similar to 330

c. **Diamine Colours from**

p- Diamines (*p*- Phenylene diamine, Benzidine etc.)

No. 331–530

d. **Trisazo Dyes** of different Constitution

$R \rightarrow R^{I} \rightarrow R^{II} \rightarrow R^{III}$

$R \rightarrow {}^{I}R \rightarrow {}^{II}R \rightarrow R^{III}$

No. 531–605

e. **Tetrazo Dyes of different constitution**

$R \rightarrow R^{I} \leftarrow R^{II} \leftarrow R^{III}$

Nos. 606–619

Leather Brown (GrE) Hydrochloride of bis-*p*-amino-benzene-disazo-*m*-phenylene-diamine. No. 230 (208)	A glistening blackish powder. H_2O: brown solution. HCl: yellower solution and partial precipitate. NaOH: brown precipitate of the colour base. H_2SO_4: brown solution, yellowish-brown precipitate on dilution. Light: 4 on cotton; 2 on leather. Dyes leather and unmordanted jute brown.	
Clayton Cotton Brown (CAC) Terra-cotta F (Gy) Sodium salt of Primuline-azo-*m*-phenylenediamine-azo-α-naphthalene-4-sulphonic acid. No. 231 (209)	A dark brown powder. H_2O: brown solution. HCl: brown precipitate. NaOH: soluble brown precipitate. H_2SO_4: reddish-violet solution, brown precipitate on dilution. Dyes cotton direct brown from a neutral or faintly alkaline bath, with addition of Glauber's salt. Light: 3–4. A satisfactory white discharge cannot be obtained in calico printing by the use of the usual reagents.	Not used.

Acid Brown R (LDC) (A) Sodium salt of benzene-azo-*m*-phenylene-diamine-azo-α-naphthalene-4-sulphonic acid. No. 232.	A brown powder. H_2O: brown solution. HCl: brown precipitate. NaOH: unaltered. H_2SO_4: dull olive-green solution; reddish solution and then brown precipitate on dilution. Dyes wool brown from an acid bath.	
Cotton Orange R (B) Sodium salt of Primuline-azo-disulpho-*m*-phenylenediamine-azo-benzene-*m*-sulphonic acid. No. 233 (210)	A brown powder. H_2O: orange-red solution. HCl: reddish precipitate. NaOH: unaltered. H_2SO_4: bright red solution, reddish precipitate on dilution. HNO_3: red. Dyes cotton direct level orange from a boiling bath. Used also for dyeing silk and union. Light: 3–4. A satisfactory white discharge cannot be obtained in calico printing by the use of the usual reagents.	
Resorcin Brown A conc. (H) (SCI) (A) (K) (BDC) Orange Special AP (StD) Sodium salt of *p*-sulphobenzene-azo-resorcinol-azo-*m*-xylene. No. 234 (211)	A brown powder. H_2O: brown solution. HCl: brown precipitate. NaOH: reddish-brown solution. H_2SO_4: reddish-brown solution, brown precipitate on dilution. Light: 2–3. Dyes wool brown from an acid bath. Used largely for dyeing leather.	
Fast Brown (By) Resorcin Dark Brown (JBS) (BK) Sodium salt of bis-4-sulpho-α-naphthalene-disazo-resorcinol. No. 235 (213)	A brown powder. H_2O: brown solution. HCl: reddish-brown soluble precipitate. NaOH: cherry-red solution. H_2SO_4: currant-red solution, dark brown precipitate on dilution. Dyes wool from an acid bath reddish-brown, moderately fast to light and washing, and of good fastness to alkalies and acids. When dyed on chrome-mordanted wool it is faster to milling, but is not faster to light. Light: 3.	
Janus Yellow G, R, (MLB) Union Yellow A (MLB) Basic disazo dyes, derived from *m*-aminophenyltrimethylammonium chloride. No. 236 (222)	*Janus Yellow G*— A light brown powder. H_2O: yellowish-brown solution. HCl: darker solution. NaOH: brown precipitate. H_2SO_4: magenta-red solution; yellowish-brown solution on dilution. Dyes cotton mordanted with tannin and tartar emetic, or cotton direct and after-treated with tannin, and unions from an acid bath yellow. *Janus Yellow R*— A brownish-orange powder. H_2O: yellowish-brown solution.	

	HCl: yellowish-brown precipitate. NaOH: brown precipitate. H_2SO_4: magenta-red solution, yellowish-brown precipitate on dilution. Light: 2–3. Dyes cotton in a similar manner to Janus Yellow G above. Used for dyeing cotton, unions, jute and artificial silk, and for dyeing compound shades.	
Patent Fustin GO (YDC) *Wool Yellow* (B) A mixture of bis-benzene-disazo-maclurin. No. 237.	A brownish-yellow powder or brownish-yellow paste. H_2O: almost insoluble. Alcohol: yellowish-brown solution. NaOH: yellowish-brown solution. H_2SO_4: yellowish-brown solution, brownish-yellow precipitate on dilution. Light: 2–3. Dyes chrome-mordanted wool or wool from an acid bath level brownish-yellow, moderately fast to light and milling and of good fastness to stoving.	
Stellachrome Brown G (JBS) Anthracene Brown (CD) Anthracene Acid Brown R, G (C) Sodium salt of *p*-sulphobenzene-azo-salicylic-acid-azo-*p*-nitrobenzene. No. 238 (221)	*Anthracene Acid Brown G* (C)— A grey powder with a violet tint. H_2O: reddish-brown solution. HCl: brown precipitate. NaOH: reddish-yellow solution. H_2SO_4: bluish-green solution, brown precipitate on dilution. Dyes wool, from an acid bath and after-chromed, yellowish-brown. *Anthracene Acid Brown* G, N. R (C) are all of good fastness to light, but the brand R is the fastest to light. Relation to cotton 2–3; relation to silk G 2–3. N, R 4. Light: 2–3.	
Fast Brown G, A, GL, GR, (tM) (A) Acid Brown J. G, (StD) (tM) Sodium salt of bis-*p*-sulphobenzene-disazo-α-naphthol. No. 239 (212)	A brown powder. H_2O: reddish-brown solution. HCl: violet precipitate. NaOH: cherry-red solution. H_2SO_4: violet solution; yellowish-brown solution on dilution. Dyes wool from an acid bath yellowish-brown of only moderate fastness. Light: 3. Level-dyeing 1; relation to cotton 1. Used mainly for dyeing leather and for shading in dyeing wool.	
Fast Brown NT (LDC) (MLB) Sodium salt of bis-sulphoxylene-disazo-α-naphthol. No. 240 (214)	A dark brown powder. H_2O: brown solution. Alcohol: ruby-red solution. HCl to aqueous solution: violet-red precipitate. NaOH: reddish-yellow solution. H_2SO_4: violet solution; red solution on dilution. Dyes wool and silk brownish-red from an acid bath. Light: 2–3.	Scarcely used.

	Level-dyeing 4; relation to cotton 3; relation to silk 3. Used also for the manufacture of lakes.	
Wool Black 4B, 6B, (LDC) (A) (A) Palatine Black A, 4B, (B) Sodium salt of *p*-sulphobenzene-azo-4-sulpho-1-amino-8-naphthol-azo-α-naphthalene. No. 241 (220)	A brownish-bronze powder. H_2O: dark blue solution. Alcohol: sparingly soluble. HCl to aqueous solution: bluish-green solution; dark precipitate with excess. NaOH: pure blue solution. H_2SO_4: blue solution, granular blue precipitate on dilution. Light: 2–3. Dyes wool, and silk black from an acid bath.	Little used.
Nigrophor BASF (B) Sodium salt of 2:5-dichlorobenzene-azo-1-amino-8-naphthol-5-sulphonic, acid. No. 242 (218)	Used for the production of insoluble azo colours in calico printing. The greenish-black obtained by coupling with diazotised *p*-nitro-aniline or α-naphthylamine possesses good fastness to soaping and excellent fastness to chlorine and acids.	
Domingo Blue-Black B, 2B, 4B (L) Sodium salt of *p*-nitrobenzene-azo-3:5-disulpho-1-amino-8-naphthol-azo-benzene. No. 243 (216)	*Domingo Blue Black B*— A blackish-brown powder with a violet tint. H_2O: dull violet solution. HCl: blue solution. NaOH: unaltered. H_2SO_4: dull green solution; blue solution and then violet precipitate on dilution. Light: 2–3. Dyes wool black, with a bluish cast, from an acid bath, and silk from a boiled-off liquor bath. Used also for printing wool and silk. Discharged by zinc dust or stannous chloride.	
Blue-Black N (K) Sodium salt of *p*-nitrobenzene-azo-4:6-disulpho-1-amino-8-naphthol-azo-benzene. No. 244 (215)	A dark brown powder. H_2O: blue solution. Alcohol: blue solution. HCl to aqueous solution: bluish-green precipitate. NaOH: blue precipitate. H_2SO_4: bluish-green solution, bluish-green precipitate on dilution. Dyes wool bluish-black from an acid bath. Light: 3. Level-dyeing 3; relation to cotton 1–2; relation to silk 3–4.	No longer used.
Chrome Patent Green C, N, (K) Sodium salt of 2-hydroxy-3:5-dinitrobenzene-azo-4:6-disulpho-1-amino-8-naphthol-azo-benzene. No. 245 (219)	C greyish-black powder; N dark brown powder. H: W: $\underline{643,8}\vert\underline{592,2}$ A: $\underline{697,3}\vert 594,8$. H_2O: C violet-blue solution; N dull blue solution. HCl: bluish-green precipitate. NaOH: C scarcely altered; N blue precipitate. H_2SO_4: dark green solution, bluish-green precipitate on dilution. Dyes wool from an acid bath bluish-green, converted into a yellower and deeper shade by after-chroming.	Not used to-day.

	Level-dyeing 4; relation to cotton 1; relation to silk 4. Light: 2–3.	
Naphthol Blue-Black S, 10BG, **B conc.** (C) (Gy) B, S, conc. (L) (C) 10 B, (S) Acid Blue-Black (Br) Coomassie Blue-Black (BDC) Acid Black (SCI) Naphthylamine Black 10B, (By) Azo Dark Blue S (S) Amine Black 10B (A) Agalma Black 10B, 12B, (B) Audol Black 6G (t.M) Sodium salt of *p*-nitrobenzene-azo-3:6-disulpho-1-amino-8-naphthol-azo-benzene. No. 246 (217)	A dark brown powder. H_2O: blackish-blue solution. Alcohol: moderately soluble. HCl to aqueous solution: blue precipitate. NaOH: unaltered. H_2SO_4: green solution, blue precipitate on dilution. Zinc dust and acetic acid: decolorised, but when poured on to filter paper a blue colour returns. Dyes wool greenish-black from an acid bath. Level-dyeing 4; relation to cotton 2–1; relation to silk 3. Light: 2–3. Used largely for dyeing woollen piece goods containing white cotton stripe effects, as the cotton remains unstained; also for shading wool and silk in unions: also in printing wool and silk. Discharged white by hydrosulphite on wool and silk. This colouring matter is the basis of all the ordinary black acid dye mixtures upon the market, the majority of which are shaded either with an orange acid dye or with a mixture of a red and a yellow acid dye.	The most important dye of this class.
Azo Dark Green A (Gy) Sodium salt of *p*-amino-benzene-azo-3:6-disulpho-1-amino-8-naphthol-azo-benzene. No. 247.	A brownish-black powder. H_2O: bluish-green solution. HCl: bluish-violet precipitate. NaOH: reddish-violet solution. H_2SO_4: dull green solution; bluish-green solution and then bluish-violet precipitate on dilution. Dyes wool level greenish-black from an acid bath. Light: 2–3. Used mainly for shading logwood black.	
In Substance: **Oil Scarlet** LB, (A) (SCI) Red C (B) **Oil Ponceau** G (K) On the Fibre— Sudan III; G (A) Amidoazobenzene Red (MLB) Benzene-azo-benzene-azo-β-naphthol. No. 248 (223)	*In Substance—* A brown powder, which crystallises from acetic acid in brown plates with a green metallic lustre, M. P. 195°. H_2O: insoluble. Alcohol: red solution. Spirit-varnishes, fats etc.: soluble. NaOH: insoluble. H_2SO_4: bluish-green solution; blue solution and then red precipitate on dilution. Light: 2–3. Used for colouring oils, fats, spirit-varnishes, &c. *On the Fibre—* Dyes cotton, padded with β-naphthol and developed with diazotised aminoazobenzene, garnet red, converted into brown by after-treatment with copper salts.	

Cloth Red G (By) **Azo Coccin** 7B (A) Silk Red R (B) Sodium salt of benzene-azo-benzene-azo-α-naphthol-4-sulphonic acid. No. 249 (224)	A brown powder. In water: about λ = 515 and 477. H_2O: sparingly soluble with a magenta-red colour. HCl: brownish-red precipitate. NaOH: soluble, reddish-violet precipitate. H_2SO_4: bluish-violet solution, brownish-red precipitate on dilution. Dyes wool and silk from an acid bath, or from a neutral bath, red. Light: 2–3. Used also for the manufacture of lakes.
Croceine AZ (C) Sodium salt of benzene-azo-benzene-azo-α-naphthol-3:6-disulphonic acid. No. 250 (225)	A brown powder. H_2O: red solution. HCl: brownish-red solution. NaOH: crimson-red solution. H_2SO_4: reddish-violet solution; blue solution and then brown solution on dilution. Dyes wool from an acid bath, or from a neutral bath, bluish-red, and cotton and jute bluish-red with alum and Glauber's salt. Levels well and possesses good fastness to light and carbonising, and resists a mild milling, but the fastness to stoving is poor. Light: 2–3.
Croceine *B (Sch)* *Croceine Scarlet* *B (Sch)* Sodium salt of benzene-azo-benzene-azo-α-naphthol-4:8-disulphonic acid. No. 251 (226)	A brownish-red powder. H_2O: sparingly soluble with a magenta-red colour. HCl: violet and then brown precipitate. NaOH: violet solution. H_2SO_4: violet solution, violet-brown precipitate on dilution. Dyes wool red from an acid bath. Light: 3. Used also for dyeing cotton (with addition of alum) bluish-red shades.
Brilliant Croceine M, 3B (By) (C) (GrE) (By) (GrE) (tM) Croceine Scarlet 3B, 9187K (BDC) Ponceau BO extra (A) Cotton Scarlet, 3B (B) (K) Sodium salt of benzene-azo-benzene-azo-β-naphthol-6:8-disulphonic acid. No. 252 (227)	A light brown powder. *Cotton Scarlet* 3B: W: 536,5|498,5 A: 537,5|499,5. H_2O: cherry-red solution. HCl: brown precipitate. NaOH: brown solution. H_2SO_4: reddish-violet solution; blue solution and then red solution and brown precipitate on dilution. Dyes wool and silk red from an acid bath. Paper and cotton are dyed with addition of alum. Level-dyeing 4; relation to cotton 2–3; relation to silk 4. Light: 3. Used also for the manufacture of lakes.
Ponceau SS (A) Cloth Red 3R (NAC)	A brown powder. H_2O: magenta-red solution. HCl: violet precipitate. NaOH: reddish-violet solution.

Sodium salt of benzene-azo-benzene-azo-β-naphthol-3:6-disulphonic acid. No. 253.	H_2SO_4: violet solution, violet precipitate on dilution. Dyes wool red from an acid bath. Light: 3–4	
Ponceau 5R (LDC) (K) (MLB) Erythrine (CD) X, P (B) Sodium salt of benzene-azo-benzene-azo-β-naphthol-3:6-8-trisulphonic acid. No. 254 (228)	A brown powder. W: 511,5|552,0 A: 509,0|548,5 H_2O: cherry-red solution. Alcohol: almost insoluble. HCl to aqueous solution: brown flocculent precipitate. NaOH: brownish-violet solution. H_2SO_4: violet solution; blue solution and then red solution on dilution. Dyes wool and silk bluish-red from an acid bath. Level-dyeing 4; relation to cotton 1; relation to silk 3. Light: 3–4.	
Azo Acid Violet A2B, A2R, AL, B, extra, R extra, 4R (By) Sodium salt of benzene-azo-benzene-azo-1:8-dihydroxynaphthalene-4-sulphonic acid. No. 255 (229)	*Azo Acid Violet 4R*— A dark brown powder. W: 529,5|570,5 A: 583,0 542,5 H_2O: red solution. A2B: W: 530,5|572,0? A: 579,0 537,0 (500,0?) HCl: bluer solution. NaOH: soluble, orange-red precipitate. H_2SO_4: violet-red solution; red solution on dilution. HNO_3: red sol. *Azo Acid Violet AL*— A violet-brown powder. H_2O: red solution. HCl: unaltered. NaOH: unaltered. H_2SO_4: reddish-blue solution; red solution on dilution. HNO_3: red sol. Dyes wool from an acid bath level reddish-violet, moderately fast to light, washing, acids and stoving, but sensitive to alkalies. Discharged by zinc dust and stannous chloride.	
Pontacyl Cloth Red 3G (DuP) *Cloth Red* 3GA, 3G extra, (A) (By) 3G (GrE) Sodium salt of *o*-toluene-azo-*o*-toluene-azo-β-naphthylamine-6-sulphonic acid. No. 256 (230)	A brownish-red powder. H_2O: red solution. Alcohol: red solution. HCl to aqueous solution: dark reddish-brown precipitate. NaOH: unaltered. H_2SO_4: dark greenish-blue solution, brownish-red precipitate on dilution. Dyes wool and silk from an acid bath, or from a neutral bath, red, rendered fast to light and milling by afterchroming. The fastness to water on silk is good. Light: 2–3.	
Cloth Red 3B extra (By) Sodium salt of *o*-tolu-	A dark brown powder. In water: about $\lambda = 505$. H_2O: cherry-red solution.	

ene-azo-*o*-toluene-azo-ethyl-β-naphthyl-amine-7-sulphonic acid. No. 257 (231)	HCl: dull brown precipitate, greenish-blue colour with excess. NaOH: red precipitate. H_2SO_4: greenish-blue solution, reddish-brown precipitate on dilution. Light: 3 Dyes wool from an acid or neutral bath, or wool in a single bath with metachrome mordant, or chrome-mordanted wool bluish-red, fast to milling against white wool. Used also for dyeing unions for wool and silk.	
In Substance— **Oil Ponceau** (W) (MLB) **Fat Ponceau** LB (SCI) **Sudan IV** (A) **Spirit Red** III (BDC) **Biebrich Scarlet** **R medicinal** (K) *On the Fibre*— Fast Garnet L, G base (GrE) Fast Azo Garnet M (MLB) *o*-Toluene-azo-*o*-toluene-azo-β-naphthol. No. 258 (232)	*In Substance*— A dark reddish-brown powder. W: insoluble A: 508,0|548,5 H_2O: insoluble. Alcohol or benzene: bluish-red solution. NaOH: to alcoholic solution: reddish-violet solution. H_2SO_4: bluish-green solution, red precipitate on dilution. Used for colouring varnishes, fats and oils. *Biebrich Scarlet R*, medicinal (K), pure *o*-toluene-azo-*o*-toluene-azo-β-naphthol, (M. P. 184–185°) after sintering at 175°, is recommended for promoting, the growth of skin on wounds, and is used in the form of a 5–10% solution in oil, or as an ointment. *On the Fibre*— Dyes cotton, padded with β-naphthol an ddeveloped with diazotised *o*-aminoazotoluene, brownish-Bordeaux. Used also in calico printing. Light: 1–2. Discharged white by hydrosulphite.	
Cloth Red B (By) 2B, Palachrome Red 2B paste (PAC) Sodium salt of *o*-toluene-azo-*o*-toluene-azo-α-naphthol-4-sulphonic acid. No. 259 (233)	A dark brownish-red powder. H_2O: red solution. Alcohol: red solution. HCl to aqueous solution: red precipitate. NaOH: violet solution. H_2SO_4: blackish-blue solution, red precipitate on dilution. Dyes wool from an acid bath red. rendered fast to light, carbonising and dry-steaming, and moderately fast to milling by after-chroming, or wool in a single bath with metachrome mordant. Light: 2.	Very good product.
Croceine 3B (Sch) Sodium salt of *o*-toluene-azo-*o*-toluene-azo-α-naphthol-4:8-disulphonic acid. No. 260 (235)	A dark brown powder. H_2O: magenta-red solution. HCl: violet precipitate. NaOH: violet solution. H_2SO_4: blue solution; violet precipitate and then magenta-red solution on dilution. Light: 2–3. Dyes wool and silk red from an acid bath.	

Cloth Red G, G extra, (GrE) GA, (A) (By) Acidol Cloth Red G (tM) Sodium salt of *o*-toluene-azo-*o*-toluene-azo-β-naphthol-6-sulphonic acid. No. 261 (234)	A reddish-brown powder. In water: about $\lambda = 517$. H_2O: sparingly soluble, with a brownish-red colour. HCl: brownish-red precipitate. NaOH: yellowish-brown precipitate. H_2SO_4: blue solution, brownish-red precipitate on dilution. Dyes chrome-mordanted wool dark red from an acid bath, or wool red from a neutral bath. Light: 2–3. Level-dyeing moderate.	
Cloth Red **BL, BA, BC, BO, O,** (GrE) (K) (A) (By) (GrE) (MLB) Wool Red B (C) Fast Bordeaux O (MLB) Sodium salt of *o*-toluene-azo-*o*-toluene-azo-β-naphthol-3:6-disulphonic acid. No. 262 (236)	A dark brown powder. In water: $\lambda = 523.3$. H_2O: magenta-red solution. HCl: browner solution and brown precipitate. NaOH: claret-red precipitate. H_2SO_4: blue solution, brownish-red precipitate on dilution. Dyes wool or chrome-mordanted wool bluish-red from an acid bath, or wool red from a neutral bath. Light: 2–3. Level-dyeing 3; more level shades are obtained when a chromium mordant is present in the dyebath. Used to replace sanders wood in wool dyeing, and for shading metachrome colours.	
Bordeaux BX (LDC) (By) Sodium salt of *m*-xylene-azo-*m*-xylene-azo-β-naphthol-6-sulphonic acid. No. 263 (237)	A greenish-brown powder. In water: $\lambda = 522.5$. H_2O: brownish-red solution. Alcohol: Bordeaux-red solution. HCl to aqueous solution: brownish-red precipitate. NaOH: brownish-red precipitate. H_2SO_4: green solution, brownish-red precipitate on dilution. Dyes wool from an acid bath Bordeaux-red, fast to light, stoving and acids. Light: 2–3. Used also for dyeing jute.	
Union Fast Claret (LDC) (Lev) Orchil Red (WSS) A (B) Sodium salt of *m*-xylene-azo-*m*-xylene-azo-β-naphthol-3:6-disulphonic acid. No. 264 (238)	A dark brown powder. H_2O: bluish-red solution. HCl: brownish-red flocculent precipitate. NaOH: soluble brown precipitate. H_2SO_4: dark blue solution, reddish-brown precipitate on dilution. Dyes wool from an acid bath archil red, fast to light and washing, moderately fast to acids and alkalies. The shades on chrome-mordanted wool are somewhat browner. Light: 2–3. Used also for dyeing unions uniform shades from a single bath.	
Azotol C (C) *p*-Dimethylamino-benzene-azo-benzene-azo-β-naphthol. No. 265 (239)	Dyes cotton, padded with β-naphthol and developed with diazotised Azotol C, bluish-black of good fastness to light, *acids and soap*.	

Janus Red B (MLB) Union Red (MLB) Chloride of *m*-trimethylamino-benzene-azo-*m*-toluene-azo-β-naphthol. No. 266 (240)	A reddish-brown powder. In water: $\lambda = 513.5$. H_2O: red solution. Alcohol: red solution. HCl to aqueous solution: brownish-red flocculent precipitate. NaOH: bluish-violet precipitate. H_2SO_4: green solution, red precipitate on dilution. Dyes cotton mordanted with tannin and tartar emetic, or cotton direct from an acid bath red. Light: 3–4. Used for dyeing unions from a single bath, and for artificial silk.	
Acid Black BX (CCC) Neutral Grey G (NCW) (A) Sodium salt of benzene-azo-α-naphthalene-azo-7-amino-1-naphthol-3-sulphonic acid. No. 267 (241)	A black powder. H_2O: sparingly soluble with a blackish-violet colour. Alcohol: violet-red solution. HCl to aqueous solution: dark precipitate. NaOH: dark precipitate. H_2SO_4: bluish-green solution; blue solution and then violet precipitate on dilution. Dyes cotton direct pure grey from a Glauber's salt and soda or soap bath. Light: 3–4. Used also for dyeing silk and half-silk.	
Nyanza Black B (A) Sodium salt of *p*-amino-benzene-azo-α-naphthalene-azo-7-amino-1-naphthol-3-sulphonic acid. No. 268 (245)	A brownish-black powder. H_2O: dark violet solution. HCl: dark violet precipitate. NaOH: soluble violet precipitate. H_2SO_4: blue solution, violet precipitate on dilution. Dyes wool and cotton direct level black from a neutral bath, and silk from a bath rendered faintly acid with acetic acid. Light: 3. Used also for diazotisation and development on the fibre, the shades thus obtained being fast to milling, washing and rubbing.	
Coomassie Wool Black **R (Lev)** Sodium salt of *p*-amino-benzene-azo-α-naphthalene-azo-β-naphthol-6-sulphonic acid. No. 269 (243)	A black powder. H_2O: violet solution. HCl: precipitate. NaOH: unaltered. H_2SO_4: green solution, wine-red solution on dilution. Dyes wool fast violet-black from an acid bath. Light: 2–3.	
Coomassie Wool Black **S (Lev)** Sodium salt of *p*-amino-benzene-azo-α-naphthalene-azo-β-naphthol-3:6-disulphonic acid. No. 270 (244)	A black powder. H_2O: bluish-black solution. HCl: redder solution. NaOH: unaltered. H_2SO_4: green solution; red solution on dilution. Dyes wool from an acid bath level black, fast to light and washing. Light: 2–3.	
Sulphon Black G, R (By)	Dark brown powders. H_2O: sparingly soluble with a reddish-violet colour.	

Sodium salt of benzene-azo-6- or 7-sulpho-d-naphthalene-azo-1:8-dihydroxynaphthalene-4-sulphonic acid. No. 271 (242)	HCl: dark blue precipitate. NaOH: R brownish-red precipitate, G brownish-violet precipitate. H_2SO_4: greenish-blue solution; dark green solution and then blue precipitate and solution on dilution. Dyes wool and silk from a faintly acid bath, or from a neutral bath, black of moderate fastness to light and milling. Light: 2.
Granite Black (A) Sodium salt of 2-hydroxy-3:5-dinitrobenzene-azo-6- or 7-sulpho-α-naphthalene-azo-β-naphthol. No. 272.	A brownish-black powder. H_2O: dull violet-blue solution. Alcohol: sparingly soluble with a bluish-violet colour. HCl to aqueous solution: dark violet-blue precipitate. NaOH: dark greenish-blue precipitate. H_2SO_4: blackish-violet solution, dark violet-blue precipitate on dilution. Dyes wool from an acid bath blackish-violet, converted by after-chroming into deep black, of good fastness to light and washing. Light: 1–2. Rubbing: 3!
Benzo Brown 3G extra (By) Dianil Brown 3GO (MLB) Benzamine Brown 3G (WDC) Sodium salt of *p*-sulpho-benzene-azo-benzene-azo-*m*-phenylenediamine. No. 273	A brown powder. H_2O: brown solution. HCl: brown precipitate. NaOH: darker brown solution. H_2SO_4: deep violet solution; redder solution and then brown precipitate on dilution. HNO_3: violet sol. Dyes cotton direct from a neutral or alkaline bath, or wool from a bath containing ammonium acetate, brown of good fastness. Used also in calico printing. Discharged white by hydrosulphite, but not by stannous chloride or chlorate. Little used. Light: 3.
Milling Orange (LDC) (WDC) Acid Alizarine Orange GR (MLB) Sodium salt of *p*-sulphobenzene-azo-benzene-azo-salicylic acid. No. 274 (250)	A reddish-brown powder. H_2O: orange-red solution. HCl: greyish-yellow gelatinous precipitate. NaOH: dark red solution and precipitate. H_2SO_4: violet solution, greyish-yellow precipitate on dilution. Dyes wool from an acid bath and after-chromed orange-red, fast to acids, alkalies and light. Light: 2–3.
Cloth Scarlet G (LDC) (K) (OeV) Chrome Red (DPC) Sodium salt of *p*-sulphobenzene-azo-benzene-azo-β-naphthol. No. 275 (246)	A reddish-brown crystalline powder. H_2O: scarlet solution. HCl: yellower solution; when concentrated, light red flocculent precipitate. NaOH: brown flocculent precipitate. H_2SO_4: green solution; bluish-red solution and then scarlet solution on dilution. Dyes wool or chrome-mordanted wool from an acid bath red, fast to alkalies

	and acids, and very fast to washing, but white wool or cotton are stained during milling. Jute is dyed with addition of alum. Light: 2. **Important.**	
Fast Scarlet B (LDC) (K) (OeV) Sodium salt of *p*-sulphobenzene-azo-benzene-azo-β-naphthol-6-sulphonic acid. No. 276 (248)	A reddish-brown powder. H_2O: scarlet-red solution. HCl: brown solution and precipitate. NaOH: reddish-violet solution. H_2SO_4: blue solution; red solution on dilution. Dyes wool, silk and jute scarlet from an acid bath. Light: 2.	
Croceine Scarlet (FB) 3B (RF) (By) (CJ) (K) (OeV) (tM) Erythrine 2R (By) Sodium salt of *p*-sulphobenzene-azo-benzene-azo-β-naphthol-8-sulphonic acid. No. 277 (249)	A reddish-brown powder. In water: $\lambda = 537.3$ and $\lambda = 503.0$. H_2O: scarlet-red solution. HCl: yellowish- brown flocculent precipitate. NaOH: violet-red solution, and precipitate. H_2SO_4: pure blue solution; violet solution, yellowish-brown precipitate and then red solution on dilution. HNO_3: blue then brown. Dyes wool and silk from an acid bath, and cotton from an alum bath scarlet. Level-dyeing 3; relation to cotton 3; relation to silk 3–4. Light: 2–3. Used also for colouring paper.	
Chlorazol Fast Red K (BDC) Benzo Fast Red 8BL (By) Sodium salt of *p*-sulphobenzene-azo-benzene-azo-6-benzoylamino-1-naphthol-3-sulphonic acid. No. 278.	A violet-brown powder. $\lambda = 505$ for 8BL H_2O: red solution. $\lambda = 500.5$ for 6BL HCl: brown solution and precipitate. NaOH: violet solution and precipitate. H_2SO_4: blue solution, brown precipitate on dilution. Dyes cotton direct from a Glauber's salt and soda bath level red, fast to light and of good fastness to ironing, acids and alkalies, but of moderate fastness to washing. Used also for dyeing uniform shades on unions and half-silk; also in calico printing. Discharged white by rongalite C.	
Wool Black (RF) (A) (B) Sodium salt of *p*-sulphobenzene-azo-*o*-sulphobenzene-azo-*p*-tolyl-β-naphthylamine. No. 279	A bluish-black powder. H_2O: bluish-violet solution. HCl: reddish-violet solution. NaOH: violet precipitate. H_2SO_4: blue solution, brown precipitate on dilution; on boiling decomposition occurs, with formation of aminoazobenzene disulphonic acid and tolunaphthazine (Witt). Dyes wool bluish-black from an acid bath.	
Croceine Scarlet 5R (LBH) **Bierbrich Scarlet**	A reddish-brown powder. H_2O: orange-red solution. λ· in H_2O 503; 561.5	

B extra fine, (LDC) (K) Ponceau 3RB, BS, B extra (CD) (DPC) (A) (BK) (Gy) (MLB) Sodium salt of *p*-sulphobenzene-azo-*o*-sulphobenzene-azo-*β*-naphthol. No. 280 (247)	Alcohol: moderately soluble. HCl to aqueous solution: red flocculent precipitate if solution is concentrated. NaOH: brown-red precipitate soluble with a violet colour. H_2SO_4: green solution; blue solution, red solution and then brownish-red flocculent precipitate on dilution. Alum: insoluble precipitate (distinction from Croceine Scarlet 3B, No. 277). Dyes wool from an acid bath, or wool and silk from a neutral bath, bluish-scarlet. Level-dyeing 4; relation to cotton 3–4; relation to silk 4. Used for dyeing wool, silk and jute, and also for the manufacture of lakes with alum, &c, for colouring paper.	Best Biebrich scarlet. A classical product of R. Nietzki.
Croceine Scarlet O extra (K) Sodium salt of *p*-sulphobenzene-azo-o-sulphobenzene-azo-*β*-naphthol-8-sulphonic acid. No. 281 (251)	A scarlet-red powder. H_2O: yellowish-red solution. HCl: violet solution. NaOH: violet solution. H_2SO_4: blue solution; yellowish-red solution on dilution. Dyes wool and silk scarlet-red from an acid bath.	No longer manufactured.
Ponceau S extra (A) Fast Ponceau 2B (B) Sodium salt of *p*-sulphobenzene-azo-*o*-sulphobenzene-azo-*β*-naphthol-3:6-disulphonic acid. No. 282.	A brown powder. H_2O: magenta-red solution. HCl: scarcely altered. NaOH: violet precipitate in concentrated solution. H_2SO_4: blue solution; orange-red solution on dilution. Dyes wool scarlet from an acid bath. According to Formanek a mixture.	
Cloth Scarlet R (LDC) (K) Sodium salt of *p*-sulpho-*o*-toluene-azo-*o*-toluene-azo-*β*-naphthol. No. 283 (252)	A dark brown powder. H_2O: red solution. λ in H_2O = 496.0 HCl: red precipitate. NaOH: yellowish-brown precipitate. H_2SO_4: green solution; blue solution and then red precipitate on dilution. Dyes chrome-mordanted wool and silk from an acid bath red, fast to acids and alkalies, and fast to milling as regards alteration, but of only moderate fastness to milling as regards bleeding into cotton or wool. Light: 2.	
Orseilline BB, (LDC) (By) Sodium salt of *p*-sulpho-*o*-toluene-azo-*o*-toluene-azo-*α*-naphthol-4-sulphonic acid.	A brown powder. In water: λ = 523.0. H_2O: magenta-red solution. HCl: reddish-violet solution. NaOH: yellower solution and precipitate. H_2SO_4: blue solution, magenta-red solution on dilution.	

No. 284 (253)	Dyes wool from an acid bath archil-red, moderately fast to light and milling and of good fastness to acids and alkalies. Light: 3.	
Bordeaux G (LDC) (By) (MLB) Sodium salt of *p*-sulpho-*o*-toluene-azo-*o*-toluene-azo-*β*-naphthol-6-sulphonic acid. No. 285 (254)	A brownish-red powder. In water: $\lambda = 511.0$. H_2O: red solution. Alcohol: sparingly soluble. HCl to aqueous solution: red precipitate. NaOH: violet solution. H_2SO_4: dark blue solution, red precipitate on dilution. Dyes wool red from an acid bath. Level-dyeing 4; relation to cotton 2; relation to silk 3. Light: 2–3.	
Croceine Scarlet 7B, 8B, 8BL, (By) (RF) (BY) (K) (K) Cocceine 7B, (StD) Erythrine 7B (B) Sodium salt of *p*-sulpho-*o*-toluene-azo-*o*-toluene-azo-*β*-naphthol-8-sulphonic acid. No. 286 (255)	A reddish-brown powder. H_2O: scarlet solution. λ in H_2O: 550 520. HCl: magenta-red solution and precipitate. NaOH: dull violet solution, precipitate if concentrated. H_2SO_4: blue solution; violet-red solution on dilution. Dyes wool and silk bright red from an acid bath, and cotton red from an alum bath. Level-dyeing 3; relation to cotton 3; relation to silk 3–4. Light: 2–3. Used particularly for colouring paper, and for dyeing compound shades in the place of Acid Magenta.	
Bordeaux BX (LDC) (By) Sodium salt of sulphoxylene-azo-sulphoxylene-azo-*β*-naphthol. No. 287	A dark brown powder. H_2O: red solution. Alcohol: red solution. HCl to aqueous solution: dark reddish-brown precipitate. NaOH: solution slightly browner. H_2SO_4: dark green solution; blue solution and then brownish-red precipitate on dilution. Dyes wool red from an acid bath. Light: 3.	
Cloth Fast Blue R (CAC) (SCI) **Sulphon Cyanine** G, GR, extra (By) Sodium salt of benzene-azo-6- or 7-sulpho-*α*-naphthalene-azo-phenyl-*α*-naphthylamine-8-sulphonic acid. No. 288 (256)	*Sulphon Cyanine G* (By)— A dark brown powder. H_2O: reddish-blue solution. λ: 579.5 (H_2O). HCl: greyish-blue precipitate. NaOH: soluble blue precipitate. H_2SO_4: navy blue solution; greenish-blue solution and then blue precipitate on dilution. HNO_3: yellow-brown. Dyes wool, silk and unions of wool and silk from a faintly acid bath navy blue, rendered browner by prolonged boiling or by steaming. Level-dyeing 3; relation to cotton 2; relation to silk 5. Light: 2–3.	Very important.

Coomassie Navy Blue G, GNX, 2RNX, C, G, GNX, 2RX (BDC) (Lev) **Sulphon Cyanine 5R, 3R, 5R extra** (GCC) (B) (By) Sodium salt of *m*-sulphobenzene-azo-α-naphthalene-azo-*p*-tolyl-α-naphthylamine-8-sulphonic acid. No. 289 (257)	Sulphon Cyanine 5R extra (By)— A brownish-violet powder. H_2O: violet solution. HCl: greyish-blue precipitate. NaOH: soluble violet precipitate. H_2SO_4: blue solution; greenish-blue solution and then blue precipitate on dilution. Dyes wool, silk and unions of wool and silk from a neutral bath containing ammonium acetate a redder shade of blue than No. 288, rendered browner by prolonged boiling or by steaming. Level-dyeing 3; relation to cotton 2; relation to silk 5. Light: 2–3.	
Naphthalene Acid Black 4B, S (By) Sodium salt of *m*-sulphobenzene-azo-6- or 7-sulpho-α-naphthalene-azo-α-naphthylamine. No. 290 (258)	*Naphthalene Acid Black 4B*— A brownish-black powder. H_2O: reddish-violet solution. HCl: blue solution. NaOH: red solution. H_2SO_4: blue solution; violet solution on dilution. Dyes wool and silk from an acid bath bluish-black, of good fastness to rubbing, light, dry-steaming, carbonising, stoving and washing. Light: 2–3.	
Ponceau 10RB (A) **Croceine Scarlet** 10B (K) Sodium salt of *p*-sulphobenzene-azo-*o*-anisole-azo-β-naphthol-8-sulphonic acid. No. 291 (259)	A brown powder. H_2O: red solution. λ: $\left.\begin{matrix}566.0\\528.0\end{matrix}\right\}$ in H_2O HCl: dark violet solution. NaOH: dark violet solution. H_2SO_4: blue solution; violet solution on dilution. Dyes wool and silk from an acid bath bluish-red, fast to light and washing. Light: 2–3. Bluer and darker shades are obtained by dyeing in copper vessels or by the addition of copper sulphate to the dyebath. Cotton and jute are dyed from a concentrated bath with the addition of a little alum. Discharged by stannous chloride.	
Eriochrome Verdone A (Gy) **Eriochrome Verdone** S (Gy) from p-chloroanilin-sulphonic acid. Sodium salt of *p*-sulphobenzene-azo-*p*-cresol-azo-β-naphthol. No. 292 (260)	A bronzy-black powder; S brown powder. H_2O: reddish-brown solution. λ: 500.0 in H_2O. Alcohol: bluish-red solution. HCl to aqueous solution: Bordeaux red solution or precipitate. NaOH: A violet-brown precipitate; S greenish-black precipitate. H_2SO_4: green solution, dull violet precipitate on dilution. Dyes wool from an acid bath Bordeaux-red, converted by after-chroming into bluish-green, fast to light, milling, stoving and potting. Sensitive to iron when dyed from an acid bath and after-chromed, but not sensitive to	

	iron when dyed in a single bath with metachrome mordant. Light: 1–2. Excess of acid should be avoided in the dyebath, as the dye is precipitated by acids. A. is sensitive to lime. Best chrome green for uniforms (Switzerland, Italy).	
Fast Violet R (LDC) (By) Sodium salt of *p*-sulphobenzene-azo-a-naphthalene-azo-β-naphthol-6-sulphonic acid. No. 293	A dark green, bronzy powder. H_2O: reddish-violet solution. Alcohol: reddish-violet solution. HCl to aqueous solution: reddish-violet precipitate. NaOH: bluer solution, and brownish-red precipitate. H_2SO_4: dull greenish-blue solution; grey solution and then reddish-violet precipitate on dilution. Dyes wool from an acid bath and chrome-mordanted wool reddish-violet, moderately fast to light and milling, and of good fastness to alkalies and acids. Light: 2.	
Acid Black N, R, (StD) (JDC) Buffalo Black 10B (NAC) (Sch) Sodium salt of *p*-sulphobenzene-azo-α-naphthalene-azo-8-amino-1-naphthol-3:6-disulphonic acid. No. 294 (261)	A black powder. H_2O: blue solution. Alcohol: insoluble. HCl to aqueous solution: blue precipitate. H_2SO_4: blue solution; blue precipitate on dilution. Dyes wool bluish-black from an acid bath. Light: 2–3.	
Victoria Black B (B) Analagous Dyestuffs are: Victoria Blue-Black (By) Sodium salt of *p*-sulphobenzene-azo-α-naphthalene-azo-1:8-dihydroxynaphthalene-4-sulphonic acid. No. 295 (262)	A black powder. H_2O: dark reddish-violet solution. Alcohol: partially soluble, with a blue coloration. HCl to aqueous solution: redder solution and Bordeaux red precipitate. NaOH: dark bluish-violet solution. H_2SO_4: moss-green solution; sea-green solution and then bluish-red solution on dilution. Dyes wool from an acid bath moderately level purplish-black very fast to light, acids, alkalies and stoving, but not fast to milling. The shade is moderately fast to milling on wool mordanted with dichromate and chromium fluoride. Light: 2–3. Used particularly for dyeing woolen piece goods and as a bottoming black under logwood for dyeing ostrich feathers; also for the manufacture of a universal grey dye-soap. (U. S. P. 1315961).	
Jet Black R (By) Sodium salt of *o-p*-disulphobenzene-azo-α-naphthalene-azo-	A black powder. H_2O: bluish-violet solution. Alcohol: violet solution. HCl to aqueous solution: bluish-black precipitate. NaOH: soluble bluish-violet precipi-	

phenyl-α-naphthylamine. No. 296 (263)	tate. H_2SO_4: blue solution, greenish-blue precipitate on dilution. HNO: blue green sol. Dyes wool from an acetic acid bath, or a neutral bath containing salt, bluish-black, moderately fast to light and milling, and silk from an acetic acid bath or a boiled-off liquor bath acidified with acetic acid bluish-black, of good fastness to washing. The dye is affected by copper vessels. Light: 2–3.	
Ingrain Black C (H) Sodium salt of 6 or 7-sulpho-4-amino-α-naphthalene-azo-benzene-azo-7-amino-1-naphthol-3-sulphonic acid. No. 297.	A black powder. H_2O: dark wine-red solution. Alcohol: insoluble. HCl to aqueous solution: violet precipitate. NaOH: unaltered. H_2SO_4: pure blue solution, violet precipitate on dilution. Dyes cotton direct navy blue, converted into fast black by diazotisation on the fibre and development with *m*-toluylenediamine. Light: 2–3.	
Fast Violet *B (By)* Sodium salt of 2 or 3-sulpho-*p*-toluene-azo-α-naphthalene-azo-β-naphthol-6-sulphonic acid. No. 298	A greenish-brown powder. H_2O: violet solution. Alcohol: violet solution. HCl to aqueous solution: violet precipitate. NaOH: violet precipitate with a concentrated solution. H_2SO_4: dull green solution, violet precipitate on dilution. Dyes wool, from an acid bath, or chrome-mordanted wool bluish-violet, moderately fast to light and milling, and of good fastness to alkalies and acids. Light: 3.	
Diamond Black **F (CD) (B) (By) (L)** Sodium salt of 3-carboxy-4-hydroxy-benzene-azo-α-naphthalene-azo-α-naphthol-5-sulphonic acid. No. 299 (275) **Benzo Black** *p*-Aminosalicylic acid-α-naphthylamine-gamma-acid (alkaline coupling)	A brownish-black powder. H_2O: bluish-violet solution. Alcohol: bluish-violet solution. HCl to aqueous solution: violet precipitate. NaOH: blue solution. H_2SO_4: greenish solution, violet precipitate on dilution. Dyes wool in a single bath with meta-chrome mordant, or wool from an acetic acid bath and after-chromed, or chrome-mordanted wool, bluish-black. Hard water, should not be used in dyeing. Level-dyeing 3; relation to cotton 2; relation to silk 5. Light: 2–3. Used for dyeing loose wool, slubbing and woollen piece goods.	One of the most important chrome blacks. Cheap.
Ferrochrome Silk Black (Feuerstein) A mixture of dinitroso-resorcinol (No. 1), Diamond Black F (No. 299), and glycerin. No. 300	Dyes iron-mordanted silk deep black.	Not used.

Chrome Black I (H) Sodium salt of 3-carboxy-4-hydroxy-5-sulpho-benzene-azo-α-naphthalene-azo-α-naphthol-4-sulphonic acid. No. 301	A bluish-black powder. H_2O: reddish-violet solution. HCl: crimson solution. NaOH: blue solution. H_2SO_4: bluish-green solution; violet solution on dilution. Dyes chrome-mordanted wool fast black. Light: 2.	Scarcely used.
Diamond Green B, 3G, SS (By) Sodium salt of 3-carboxy-4-hydroxy-benzene-azo-α-naphthalene-azo-1:8-dihydroxy-naphthalene-4-sulphonic acid. No. 302 (276)	*Diamond Green B* (By)— A greyish-black powder. In water: $\lambda = 578.2$. H_2O: bluish-violet solution. HCl: bluish-violet precipitate. NaOH: blue solution. H_2SO_4: bluish-green solution, blue precipitate on dilution. *Diamond Green 3G* (By)— A bronzy powder. H_2O: bluish-violet solution. HCl: reddish-violet precipitate. NaOH: cull claret red solution. H_2SO_4: reddish-violet solution; cherry-red solution and precipitate on dilution. *Diamond Green SS* (*By*)— A violet-black powder. H_2O: bluish-green solution. HCl: blue precipitate. NaOH: pure blue solution. H_2SO_4: dull bluish-grey solution, blue precipitate on dilution. Dyes chrome-mordanted wool dark bluish-green, fast to light, milling, acids and alkalies. Light: 2. Used mainly for shading; also for printing wool.	One of the best chrome greens.
Acid Chrome Black STC (By) Anthracene Acid Black LW, SAS, SR, ST, SW, (C) Sodium salt of 3-carboxy-4-hydroxy-benzene-azo-6 or 7-sulpho-α-naphthalene-azo-β-naphthol-3:6-disulphonic acid. No. 303 (277)	*Anthracene Acid Black LW* (C)— A grey powder. H_2O: violet solution. HCl: soluble violet precipitate. NaOH: bluish-violet precipitate. H_2SO_4: green solution, bluish precipitate and then violet precipitate on dilution. *Anthracene Acid Black St* (C)— A greyish-black powder. H_2O: violet solution. HCl: soluble violet precipitate. NaOH: bluish-violet solution. H_2SO_4: green solution; reddish-violet solution and precipitate on dilution. Dyes wool from an acid bath and after-chromed black, fast to light, acids, alkalies, milling and dry-steaming. Light: 2.	

	Used mainly for dyeing woollen piece goods.	
Nerol 2B (A) Sodium salt of 3-sulpho-diphenyl-amine-azo-α-naphthalene-azo-β-naphthol-6-sulphonic acid. No. 304 α or phenyl-o-tolyl.	A black powder. H_2O: bluish-violet solution. HCl: bluish-black precipitate. NaOH: unaltered. H_2SO_4: bluish-black solution; blue solution and then bluish-black precipitate on dilution. Dyes wool and silk from a faintly acetic acid bath containing Glauber's salt, or from a neutral bath, black of good fastness to washing, acids, and alkalies, and of moderate fastness to light. Light: 2–3. Used for dyeing yarns, particularly knitting yarns, and slubbing.	Important
Nerol B (*A*) Sodium salt of 3-sulpho-diphenyl-amino-azo-α-naphthalene-azo-β-naphthol-3:6-disulphonic acid. No. 305.	A brownish-black powder. H_2O: reddish-violet solution. Alcohol: sparingly soluble, with a reddish-violet colour. HCl to aqueous solution: bluish-black precipitate. NaOH: somewhat redder solution. H_2SO_4: blackish-violet solution; blue solution and then bluish-black precipitate on dilution. Dyes wool and silk from a faintly acetic acid bath containing Glauber's salt, or from a neutral bath, black of good fastness to washing, acids, and alkalies, but of only moderate fastness to light. Light: 2–3. Used for dyeing yarns, particularly knitting yarns, and slubbing.	Important
Fast Sulphon Black F, FB, (JBS) (SCC) (S) Sulphon Fast Black A (GCC) Sodium salt of 4-sulpho-α-naphthalene-azo-3:6-disulpho-1-naphthol-8-azo-β-naphthol. No. 306 (264)	A black powder. H_2O: greenish-black solution by transmitted light, or reddish solution by reflected light. Alcohol: insoluble. HCl to aqueous solution: black precipitate. NaOH: dull brownish-red solution. H_2SO_4: blackish-violet solution, black precipitate on dilution. Dyes wool and silk deep black from an acid bath. Light: 2–3. Used largely for dyeing silk. Discharged white by hydrosulphite on silk.	

Coomassie Fast Black B (BDC) **Sulphon Cyanine Black** BA, B, 2B, (GCC) (By) Alphanol black B Sodium salt of 5-sulpho-α-naphthalene-azo-α-naphthalene-azo-phenyl-α-naphthylamine-8-sulphonic acid. No. 307 (265)	*Sulphone Cyanine Black B*, dark brown powder; 2B, brownish-black powder. H_2O: violet solution. Alcohol: 2B, bluish-green solution. HCl to aqueous solution: bluish-green solution and precipitate. NaOH: reddish-violet solution. H_2SO_4: dark bluish-violet solution, bluish-green precipitate on dilution. Dyes wool and silk from a neutral or acetic acid bath bluish-black, fast to light, washing, alkalies and acids. Light: 2–3. Used for dyeing yarns, particularly knitting yarns, woollen piece goods, loose wool and shoddy.	Very important.
Acid Black W, N, D, NN, DB, DBB, (AJ) (BDC) (CAC) (By) (SCI) (ICA) **Naphthylamine Black** D (AAP) (GCC) (MLy) (C) (K) Sodium salt of 3:6-disulpho-α-naphthalene-azo-α-naphthalene-azo-α-naphthylamine. No. 308 (266)	A black powder. H_2O: violet-black solution. Alcohol: insoluble. HCl to aqueous solution: black precipitate. NaOH: soluble dark-violet precipitate. H_2SO_4: bluish-black solution; green solution and then black precipitate on dilution. Dyes wool, silk and unions from an acid bath or a neutral bath containing salt, level violet-black, moderately fast to rubbing, light and milling, but less fast to acids. Light: 2–3. Used also for shading wool in unions.	Very important in mixtures.
Anthracite Black **B, R** (C) **Phenylene Black** **(StD)** Sodium salt of 3:6-disulpho-α-naphthalene-azo-α-naphthalene-azo-diphenyl-*m*-phenylenediamine. No. 309 (267)	*Anthracite Black B*— A brownish-black powder. H_2O: violet-black solution. Alcohol: navy-blue solution. HCl to aqueous solution: brownish-olive solution and soluble blue precipitate. NaOH: violet-red precipitate. H_2SO_4: blackish-blue solution, olive-brown soluble precipitate and then blue solution on dilution. Dyes wool and silk from an acetic acid bath grey to deep black. The dyeings may be after-treated with chromium fluoride, but the fastness is scarcely improved thereby. Relation to cotton 3–4; relation to silk 4. *Anthracite Black R.* Light 1–2.	
Naphthyl Blue-Black N, NV, FB, FBB, (By) (C)	*Naphthyl Blue-Black N*— A greyish-black powder. H_2O: dark violet solution.	

Alphyl Blue-Black O, OK, (MLB) Sodium salt of 4:6- or 4:7-disulpho-α-naphthalene-azo-α-naphthalene-azo-1-amino-2-ethoxynaphthalene. No. 310 (268)	HCl: blue solution and soluble blackish-blue precipitate. NaOH: bluer solution and dark blue soluble precipitate. H_2SO_4: dark blue solution; blue solution and then bluish-violet solution on dilution. Dyes wool from an acetic acid bath and after-treated with copper sulphate, deep bluish-black. Level dyeing 4–5. Light: 2–3. Used for dyeing wool black in conjunction with logwood and for dyeing uniform shades on half-silk.	
Acid Black **FY, 6B, 5B, BR,** (AJ) (H) (tM) **Naphthol Black** RB, 6B, (AAP) (MLy) (C) (K) **Naphthol Black** (MC) (WDC) Sodium salt of 4:6- or 4:7-disulpho-α-naphthalene-azo-α-naphthalene-azo-β-naphthol-3:6-disulphonic acid.	A black powder. H_2O: violet solution. Alcohol: insoluble. HCl to aqueous solution: unaltered. NaOH: blackish-blue solution. H_2SO_4: greenish-black solution; greenish-blue solution, and then violet precipitate on dilution. Dyes wool from an acid bath level bluish-black. Relation to cotton 1; relation to silk 2. Light: 3. Used for dyeing woollen piece-goods, yarns and felt; also in printing wool. Important.	
No. 311 (269) *Blue-Black* B (B) Azo Black O (MLB) Sodium salt of 8 and 5-monosulpho-β-naphthalene-azo-α-naphthalene-azo-β-naphthol-3:6-disulphonic acid. No. 312.	A bluish-black powder. H_2O: bluish-violet solution. HCl: blue precipitate. NaOH: soluble blue precipitate. H_2SO_4: bluish-green solution; blue solution and then blue precipitate on dilution. Dyes wool bluish-violet to black from an acid bath. Light: 3.	
Brilliant Crocein 9*B* (*CD*) (*C*) A mixture of the sodium salts of 6:8-disulpho-β-naphthalene-azo-o-toluene-azo-β-naphthol-3:6- and 6:8-disulphonic acids. No. 313 (270)	A brownish-red powder. H_2O: bluish-red solution. HCl: darker and bluer solution, or violet solution with excess. NaOH: brownish-red solution. H_2SO_4: blue solution, bluish-red solution on dilution. Dyes wool from an acid bath bluish-red. Light: 2–3.	
Diamine Blue 6*G* (*C*) Sodium salt of 6:8-di ulpho-β-naphthalene-azo-2-ethoxy-α-naphthalene-azo-β-naphthol. No. 314 (271)	A dark violet powder. H_2O: dark blue solution. HCl: violet precipitate. NaOH: duller blue solution. H_2SO_4: bluish-green solution, violet precipitate on dilution. HNO_3: blue solution. Dyes cotton direct from a faintly alkaline bath blue of low fastness to light. Light: 4.	

Naphthol Black OPAS, NB, N3B, (Lev) B, (AAP) (C) (CN) Naphthalene Black 5B, (StD) Sodium salt of 6:8-disulpho-β-naphthalene-azo-α-naphthol-naphthalene-azo-β-3:6-disulphonic acid. No. 315 (272)	A bluish-black powder. H_2O: violet solution. HCl: reddish-violet precipitate. NaOH: soluble blue precipitate. H_2SO_4: green solution; bluer solution and then reddish-violet precipitate on dilution. Dyes wool blue-black from an acid bath. Level-dyeing 3; relation to cotton 1; relation to silk 2–3. Light: 2–3. Used for garment dyeing and also for printing wool.	
Diazamine Blue BR, NA, (S) (CN) *Diazo Indigo Blue* B (By) Sodium salt of 6 or 7-monosulpho-4-amino-α-naphthalene-azo-α-naphthalene-azo-β-naphthol-6-sulphonic acid. No. 316 (273)	A dark grey powder. H_2O: blue solution. HCl: soluble blue precipitate. NaOH: scarcely altered. H_2SO_4: reddish-blue solution; violet solution on dilution. Dyes cotton direct from a Glauber's salt and soda bath a worthless greenish-blue shade, which, when diazotised and developed on the fibre with β-naphthol, is converted into dark blue. Fast blacks are obtained by diazotisation and development with *m*-diamines. Shades of greater fastness to light are obtained by after-treatment with copper sulphate. Light: 3–2. Used also in calico printing. Discharged white by hydrosulphite on cotton.	
Diaminogen B extra (C) Sodium salt of 6 or 7-monosulpho-4-amino-α-naphthalene-azo-α-naphthalene-azo-7-amino-1-naphthol-3-sulphonic acid. No. 317 (274)	A grey powder. H_2O: blue solution. HCl: reddish-blue precipitate. NaOH: reddish-violet precipitate. H_2SO_4: blue to blackish-blue solution, violet to blackish-blue precipitate on dilution. Dyes cotton direct dull blue which, when diazotised and developed on the fibre with β-naphthol or a *m*-diamine, is converted into indigo-blue or black respectively, fast to light, washing, acids and alkalies. The shades on cotton and unions do not bleed in cold water. Light: 2–3. Used also for dyeing unions, half-silk and silk; also in calico printing. Discharged white by hydrosulphite on cotton.	Important.
Biebrich Patent Black 4AN (K)	A dark brown powder. H_2O: violet solution. Alcohol: blue solution. HCl to aqueous solution: blue black precipitate. NaOH: bluer solution. H_2SO_4:	

Sodium salt of 4-sulpho-α-naphthalene-azo-6 or 7-monosulpho-α-naphthalene-azo-α-naphthylamine. No. 318 (278)	bluish-green solution, bluish-black precipitate on dilution. Dyes wool from an acid bath black. Level-dyeing 2–3; relation to cotton 3; relation to silk 5. Light: 2–3. Used also for dyeing silk and in printing wool.	
Brilliant Benzo Fast Violet *BL*, 2*RL*, (By) *Diamine Fast Brilliant Blue* *R* (*C*) Sodium salt of 3:6-disulpho-8-hydroxy-α-naphthalene-azo-α-naphthalene-azo-6-phenylamine-1-naphthol-3-sulphonic acid. No. 319	Slate-grey powders. H_2O: *Brilliant Fast Blue B*, violet solution; 3BX and 2G, bluish-violet solutions; 4G, blue solution. HCl: blue precipitates. NaOH: B and 3BX, redder solutions; 2G, blue precipitate; 4G, violet solution and faint precipitate. H_2SO_4: B, green solution, violet precipitate on dilution; 3BX, violet solution, reddish-violet precipitate on dilution; 2G, greenish-black solution, bluish-violet precipitate on dilution; 4G, greenish-black solution, reddish-violet precipitate on dilution. Dyes cotton direct bright blue Light: 2–3. Used also for dyeing unions and half-silk; also in calico printing. Discharged white by hydrosulphite on cotton and moderately good discharges are obtained with stannous chloride. Benzo light blue B = H-acid $\rightarrow$ α. Naphthylamine-*p*-tolyl-J-acid.	
Biebrich Patent Black BO (K) Sodium salt of 3:6-disulpho-α-naphthalene-azo-6 or 7-monosulpho-α-naphthalene-azo-β-naphthol-3:6-disulphonic acid. No. 320.	A dark brownish-black powder. H_2O: dark reddish-violet solution. HCl: blue solution. NaOH: pure blue solution. H_2SO_4: dark greenish-blue solution; dark violet solution on dilution. Dyes wool black from an acid bath. Light: 2–3. Level-dyeing 3; relation to cotton 1; relation to silk 2–3.	
Columbia Fast Scarlet 4B (A) *Diamine Fast Scarlet* 4B, FF, 4BN, 4BFS, 4BFF, 5BFF, 6BS, 7BFS, 8BN, GFF, 10BF, GG, GS (C) Sodium salt of benzene-azo-7-sulpho-5-hydroxy-1:2-dihydronaphthimin-azole-phenyl-*m*-azo-β-naphthol-6-sulphonic acid. No. 321.	*Columbia Fast Scarlet* 4B (A), *Diamine Fast Scarlet* 8BN (C): A red powder. H_2O: scarlet solution. HCl: dark brown solution. NaOH: red precipitate. H_2SO_4: pure blue solution, brown precipitate and then brown solution on dilution. HNO_3: blue. *Diamine Fast Scarlet* 4B— A brown powder. $\left.\begin{array}{l}\text{10B}: \lambda : \underline{493.0}; 528.0\ [577.0] \\ \text{G. TF.}: \lambda : 501.0 : 546.5\end{array}\right\}$ in H_2O H_2O: red solution. HCl: scarlet precipitate. NaOH: dark bluish-red solution. H_2SO_4: dark red	

	solution, bluish-red precipitate on dilution. *Diamine Fast Scarlet* GS: A brownish-red powder. Light: 3–4. H_2O: orange-brown solution. HCl: orange-red gelatinous precipitate. NaOH: dark brown solution. H_2SO_4: orange-red solution, orange-red precipitate on dilution. Dyes cotton direct scarlet-red of good fastness to washing and particularly fast to acids, but of only moderate fastness to light. Used also in calico printing. Discharged white by hydrosulphite on cotton.	
Diamine Azo Scarlet 4B, 8B, 8B extra, 2BL, extra, 4Bl extra, 6BL extra (C) Sodium salt of *p*-sulpho-benzene-azo-7-sulpho-5-hydroxy-1:2-dihydronaphthiminazole-phenyl-*m*-azo-7-sulpho-5-hydroxy-*m*-aminophenyl-1:2-dihydronaphthiminazole. No. 322.	*Diamine Azo Scarlet* 2BL extra— A brownish-red powder. 8 B extra: 511.0 (?) H_2O: reddish-brown solution. 4 BL. extra: λ: 512.0 492.0 4 B. λ: <u>515.0</u> HCl: red precipitate. NaOH: dark brown solution. H_2SO_4: magenta-red solution, reddish-brown precipitate on dilution. HNO_3: red-violet. *Diamine Azo Scarlet 6BL extra*— A dull brownish-red powder. H_2O: bluish-red solution. HCl: bluish-red precipitate. NaOH: dark brownish-red solution. H_2SO_4: violet solution, bluish-red precipitate on dilution. *Diamine Azo Scarlet 8B extra*— A dark brown powder. H_2O: red solution. HCl: red precipitate. NaOH: darker bluish-red solution. H_2SO_4: red solution, red precipitate on dilution. HNO_3: red solution. Dyes cotton direct scarlet-red, which, when diazotised on the fibre and developed with β-naphthol, is converted into scarlet red, fast to washing and of excellent fastness to acids. Light: 3–4. Used also in calico printing. Discharged white by hydrosulphite on cotton, but the discharge with stannous chloride is slightly inferior.	
Diamine Azo Orange-RR pat. (C)	A brown powder. H_2O: orange solution. HCl: yellowish-brown gelatinous precipitate. NaOH: deeper orange solution and precipitate. H_2SO_4: scarlet solution, yellowish-brown gelatinous precipitate on dilution.	

Sodium salt of *p*-sulpho-benzene-azo-6-sulpho-3-hydroxy-1:2-naphthiminazole-phenyl-*m*-azo-6-sulpho-3-hydroxy-*m*-amino-phenyl-1:2-naphthiminazole. No. 323.	Dyes cotton direct orange-yellow to red, which, when diazotised on the fibre and developed with β-naphthol, is converted into orange to red, fast to washing and of good fastness to acids. Light: 3–4. Satisfactory white discharges cannot be obtained with any of the usual reagents.	
Diazo Brilliant Orange GR extra (By) **Diazo Brilliant Scarlet BG extra (By)** Sodium salt of *m*-amino-benzoyl-amino-*m*-benzoyl-6-amino-3-sulpho-1-naphthol-2-azo-benzene. No. 324.	*Diazo Brilliant Orange GR extra*— An orange powder. H_2O: orange solution. HCl: orange precipitate. NaOH: orange precipitate. H_2SO_4: reddish-blue solution, orange precipitate on dilution. HNO_3: red solution. Dyes cotton, silk, half-silk and artificial silk direct, and diazotised on the fibre and developed with β-naphthol, moderately level orange, fast to light, washing, alkalies and acids. *Diazo Brilliant Scarlet BG extra*— A red powder. H_2O: bluish-red solution. HCl: bluish-red precipitate. NaOH: bluish-red precipitate. H_2SO_4: reddish-blue solution, bluish-red precipitate on dilution. HNO_3: blue solution. Dyes cotton, silk, half-silk and artificial silk direct, and diazotised on the fibre and developed with β-naphthol, moderately level scarlet, fast to light, washing, alkalies and acids. Light: 3–4. Satisfactory white discharges cannot be obtained with any of the usual reagents.	
Rosanthrene O (SCI) Sodium salt of *m*-aminobenzoyl-6-amino-3-sulpho-1-naphthol-2-azo-benzene. No. 324a.	A reddish-brown powder. H_2O: orange solution. Alcohol: partially soluble, with a yellowish-brown colour. HCl to aqueous solution: orange-brown precipitate. NaOH: dark orange-brown solution. H_2SO_4: orange-red solution, reddish-brown precipitate on dilution. Dyes cotton direct orange, converted by diazotisation on the fibre and development with β-naphthol into bright orange, fast to washing, alkalies and acids, but not fast to light. Light: 3–4. *Rosanthrene A*, *B*, similarly, yield red; *CB*, deep claret; *B* brilliant scarlet; and *Rosanthrene Bordeaux*, Bordeaux red shades respectively, when diazotised on the fibre and developed with β-naphthol.	

Diamine Fast Violet BBN, FFBN, FFRN, (C) Diamine Brilliant Violet, B, RR (C) Naphthamine Fast Violet 2B (K) Sodium salt of 7-sulpho-5-hydroxy-β-naphthalene-azo-2-methyl-5-methoxy-benzene-4-azo-6-phenyl-amino-1-naphthol-3-sulphonic acid. No. 325.	*Diamine Fast Violet FFBN*— A violet-black powder. F.F.R.N.λ = 535.0 H_2O: crimson solution. F.F.R.N.λ = 518.0 HCl: blue precipitate. NaOH: reddish-violet precipitate. H_2SO_4: greenish-blue solution, violet-blue precipitate on dilution. *Diamine Fast Violet FFRN*— A violet powder. H_2O: crimson solution. HCl: blue precipitate. NaOH: bluish-violet precipitate. H_2SO_4: blue solution, violet precipitate on dilution. HNO_3: purple solution. Dyes cotton direct violet to blue, fast to light, which, when developed on the fibre with diazotised *p*-nitroaniline, is converted into violet, fast to washing. Light: 3–2. Used also for dyeing silk, half-silk and artificial silk; also in calico printing. Discharged white by hydrosulphite on cotton, but discharged white by stannous chloride only in the case of pale shades.
Benzo Fast Orange S (By) Direct Fast Orange SE (CAC) (SCI) Azo dye No. 326 (279)	*Benzo Fast Scarlet GS*— A brownish-red powder. H_2O: yellowish-red solution. HCl: reddish-brown solution. NaOH: darker solution. H_2SO_4: reddish-violet solution; soluble red flocculent precipitate on dilution. HNO_3 : red solution. *Benzo Fast Scarlet 5BS*— A brick-red powder. H_2O: scarlet-red solution. HCl: Bordeaux-red precipitate. NaOH: unaltered. H_2SO_4: indigo-blue solution, red flocculent precipitate on dilution. HNO_3: blue solution. *Benzo Fast Scarlet 8BS*— A reddish-brown powder. H_2O: Bordeaux red solution. HCl: Bordeaux red precipitate. NaOH: unaltered. H_2SO_4: indigo-blue solution, soluble red flocculent precipitate on dilution. Dyes cotton direct bright bluish-red to yellowish-red, of good fastness to washing and acids, and moderate fastness to light (3). Dyes wool, from a boiling neutral bath, bluish-red to yellowish-red, fast to washing and milling, but not so fast to light as on cotton. The wool in unions remains unstained when dyed at temperatures up to 50°.

BENZO FAST SCARLET 4BA, 4BS, (By)	Used also for dyeing silk, unions, and half-silk; also in calico printing. Discharged to a satisfactory white on cotton; by hydrosulphite in presence of leucotrope, but not by the usual reagents.	
Chlorazol Fast Scarlet 4BS (BDC) Naphthamine Fast Scarlet E4B, (K) Diamine Fast Scarlet etc. Sodium salt of benzene-azo-7:7-disulpho-5:5-dihydroxynaphthyl-2:2-urea-azo-*o*-*p*-acetyl-aminobenzene. No. 327	A reddish-brown powder. H_2O: scarlet-red solution. $\lambda = 494.5$ (4B.S) $\lambda = 506.0$ (8B.S). $\lambda = 495.5$ (4 B.A.). HCl: crimson-red precipitate. NaOH: blue solution and red precipitate. H_2SO_4: crimson-red solution, soluble brownish-red precipitate on dilution. Dyes cotton direct scarlet-red similar in shade to Benzopurpurine 4B (No. 448) and equally fast to washing, but slightly faster to light and of greatly superior fastness to acids. Light: 3. Used also for dyeing unions by the single-bath process; also in calico printing. Discharged to a satisfactory white on cotton by hydrosulphite in presence of leucotrope, but not by the usual reagents.	$\lambda = \left.\begin{matrix}562.0\\517.0\end{matrix}\right\}$ 8 BA (B.S.) $\lambda = 479.0\}$ 4B. $\lambda = \left.\begin{matrix}549\\506\end{matrix}\right\}$ 5B. $\lambda = 495.0$ G.S. $\lambda = \left.\begin{matrix}525.0\\494.0\end{matrix}\right\}$ 8F. B. $\lambda = \left.\begin{matrix}505\\(551.5)\end{matrix}\right\}$ 8BS.N $\lambda = \left.\begin{matrix}581.0\\494.0\\(537.5)\end{matrix}\right\}$ 5 B.S. **Very important direct colour.**
Azidine Fast Scarlet GGS (CJ) Sodium salt of bis-*o*-toluene-disazo-7:7-disulpho-5:5-dihydroxy-naphthalene-2:2-diamino-dicarbonyl-2:6-diamino-toluene-4-sulphonic acid. No. 328 (280)	A reddish-brown powder. H_2O: orange-red solution. λ: not distinct. Alcohol: yellowish-orange solution. HCl to aqueous solution: red flocculent precipitate. NaOH: unaltered. H_2SO_4: cherry-red solution, violet precipitate on dilution. Dyes cotton direct orange-red of excellent fastness to acids. Light: 3.	
Azidine Fast Scarlet, 4BS (CJ) Sodium salt of *o*-toluene-azo-*β*-naphthalene-azo-7:7-disulpho-5:5-dihydroxy-naphthalene-2:2-diamino-dicarbonyl-2:6-diamino-toluene-4-sulphonic acid. No. 329 (281)	A reddish-brown powder. H_2O: red solution. Alcohol: yellowish-orange solution. HCl to aqueous solution: red flocculent precipitate. NaOH: partial precipitate. H_2SO_4: violet solution, violet precipitate on dilution. Dyes cotton direct scarlet of excellent fastness to acids. Light: 2–3. Used for dyeing mattress covers; also for dyeing unions, half-silk and artificial silk; also in calico printing. Discharged white by hydrosulphite on cotton.	
Azidine Fast Scarlet 7BS (CJ) Sodium salt of bis-*β*-naphthalene-disazo-7:7-disulpho-5:5-	A brown powder. H_2O: red solution. λ: not distinct. Alcohol: yellowish-orange solution. HCl to aqueous solution: red flocculent precipitate. NaOH: partial	

dihydroxy-naphthalene-2:2-diamino-dicarbonyl-2:6-diamino-toluene-4-sulphonic acid. No. 330 (282)	precipitate. H_2SO_4: violet-blue solution, dull violet precipitate on dilution. Dyes cotton direct bluish-red of excellent fastness to acids. Light: 2-3.	
Bismarck Brown G, Y conc., Y, Y extra, B, S, (ACC) (BDC) (LDC) (DH) (SCI) (GrE) (CV) (JBS) (AAP) (CD) (MOH) (Sch) (NBC)(NAC)(GCC) (S) **Manchester Brown** (CV) (Lev) (RD) (W) Hydrochloride of benzene-*m*-disazo-bis-*m*-phenylene-diamine, together with some triamino-azobenzene- and other bases. No. 331 (283)	A dark blackish-brown powder. In water: partial absorption in blue and violet. H_2O: brown solution. λ: not distinct. Alcohol: brown solution. HCl to aqueous solution: yellowish precipitate or unaltered. NaOH: brown precipitate. Benzene-*m*-disazo-*m*-phenylenediamine is insoluble in water and crystallises from benzene (C_6H_6) (M. P. 118°). Triaminoazobenzene is soluble in water and melts at 144°. H_2SO_4: brown solution, red to yellow solution on dilution. Dyes wool, silk and leather reddish-brown from a neutral bath. The fastness is increased by after-treatment with dichromate and copper sulphate. Level-dyeing 1; relation to cotton 4; relation to silk 5. Dyes cotton mordanted with tannin and tartar emetic, and jute brown. A fine fast brown shade is obtained by developing the dyed shade on cotton with diazotised *p*-nitroaniline. Used also for colouring foodstuffs and is officially permitted for this purpose in Australia; also as a wood stain and in colouring varnishes; also in calico printing and in printing silk. Discharged white by hydrosulphite on silk and cotton.	Very important.
Bismarck Brown R, R conc. T, (BDC) (CAC) (JBS) (LBH) (NBC) (AAP) (CCC) (CD) (DPC) (HM) (S) (SCI) (T) (By) (GrE) (K) (CV) (LBH) (DH) **Manchester Brown** EE, PS, (Lev) (C) (C) Hydrochloride of toluene-2:4-disazo-bis-*m*-toluylenediamine. No. 332 (284)	A dark brown powder. H_2O: reddish-brown solution. Alcohol: reddish-brown solution. HCl to aqueous solution: yellowish-brown solution. NaOH: light brown precipitate. H_2SO_4: dark brown solution; red solution and then brown solution on dilution. Dyes wool and leather from a neutral bath, and cotton mordanted with tannin and tartar emetic, reddish-brown. Light: 3-4; or leather 2-3. A fine fast brown shade is obtained by developing the dyed shade on cotton with diazotised *p*-nitroaniline. Used also in calico printing and for silk.	

	Discharged white by hydrosulphite on cotton.	Very important.
Direct Brown G (JWL) *Toluylene Brown* G (By) (GrE) Sodium salt of 4-sulpho-toluene-2:6-disazo-*m*-phenylenediamine. No. 333 (285)	A blackish-brown powder. In water: partial absorption in blue and violet. H_2O: brown solution. Alcohol: insoluble. HCl to aqueous solution: brown precipitate. NaOH: unaltered. H_2SO_4: brownish-red solution, brown precipitate on dilution. Dyes cotton direct yellowish-brown, very fast to soap, but not fast to alkaline stoving. Light: 3–4. A fine fast brown shade is obtained by developing the dyed shade on cotton with diazotised *p*-nitroaniline. Used also in calico printing. Discharged to a dull white by hydrosulphite on cotton, but better results are obtained in presence of leucotrope.	
Toluylene Yellow (GrE) Sodium salt of 4-sulpho-toluene-2:6-disazo-bis-nitro-*m*-phenylenediamine. No. 334 (286)	A yellow powder. H_2O: yellowish-brown solution. HCl: brown precipitate. NaOH: soluble brown precipitate. H_2SO_4: brown solution, brown precipitate on dilution. Dyes cotton direct from a neutral bath containing salt reddish-yellow, of good fastness to washing, acids and chlorine, but not fast to light, and reddened slightly by alkalies. Light: 4.	
Toluylene Orange RR (GrE) Sodium salt of 4-sulpho-toluene-2:6-disazo-bis-β-naphthylamine. No. 335 (287)	A red powder. H_2O: yellowish-red solution. Alcohol: orange solution. HCl to aqueous solution: brownish-red precipitate. NaOH: yellowish-red precipitate. H_2SO_4: bluish-grey solution, brownish-red precipitate on dilution. Dyes cotton direct from a soap bath reddish-orange, not fast to alkaline stoving. Light: 3–4.	
Acid Alizarine Black SE, SE paste (JBS) (MLB) **Palatine Chrome Black** F, FN, FT (B) Sodium salt of 4-sulpho-1-hydroxy-benzene-2:6-disazo-bis-β-naphthol. No. 336 (288)	A black powder or paste. H_2O: blue solution. Alcohol: sparingly soluble, with a blue colour. HCl to aqueous solution: cherry-red solution and red precipitate. NaOH: reddish-violet solution and black precipitate. H_2SO_4: violet solution, bluish-red precipitate on dilution. HNO_3: violet solution. Dyes wool from an acid bath and afterchromed black. Level-dyeing 4–3; relation to cotton 4; relation to silk 4. Light: 1–2.	

	An excellent product, but sparingly soluble. Rubbing: 2–3.	
Acid Alizarine Black SN (JBS) (MLB) Acid Chrome Black NSN (CN) Palatine Chrome Black S (B) Sodium salt of 4-sulpho-1-hydroxy-benzene-2:6-disazo-β-naphthol-β-naphthol-6-sulphonic acid. No. 337 (289)	A black powder. H_2O: blue solution. Alcohol: insoluble. HCl to aqueous solution: red precipitate. NaOH: violet solution. H_2SO_4: violet solution; reddish-brown solution and precipitate on dilution. Dyes wool from an acid bath and after-chromed blue-black; very suitable for machine dyeing. Level-dyeing 4; relation to cotton 2; relation to silk 3. Light: 1–2. More soluble than 337, but not so fast to potting and milling.	
Violet Black (B) Sodium salt of benzene-1:4-disazo-α-naphthylamine-α-naphthol-4-sulphonic acid. No. 338 (290)	A black powder with a bronzy lustre. H_2O: brownish-red solution. HCl: violet precipitate. NaOH: violet solution. H_2SO_4: blue solution, violet precipitate on dilution. Dyes wool from a neutral bath, and cotton from an alkaline bath, violet-black of only moderate fastness to light and washing. Light: 3–4. Used mainly as a bottom and mordant for basic dyes. The first black substantive dye.	Scarcely used.
Para Black R (By) Sodium salt of benzene-1:4-disazo-*m*-phenylenediamine-1-amino-8-naphthol-4:6-disulphonic acid. No. 339	A brownish-black powder. H_2O: dark reddish-violet solution. Alcohol: sparingly soluble with a bluish-violet colour. HCl to aqueous solution: maroon precipitate. NaOH: violet solution and faint precipitate. H_2SO_4: blue solution; violet solution and then maroon precipitate on dilution. Dyes cotton from an alkaline bath dark blue, converted by development with diazotised *p*-nitroaniline into deep black, fast to washing. Light: 3. Used also in calico printing. Discharged by hydrosulphite on cotton.	No longer in use.
Chrome Red S pdr. (Br) Sodium salt of benzene-1:4-disazo-salicylic-acid-β-naphthylamine-6-sulphonic acid. No. 340.	A dull red powder. H_2O: soluble; yellow solution. No: λ. HCl: brown precipitate. NaOH: unaltered. H_2SO_4: dark blue solution; brown solution and precipitate on dilution. Dyes wool in a single bath with metachrome mordant, or chrome-mordanted wool, bluish-red of moderate fastness to light, good fastness to milling and alkalies, and excellent fastness to washing and potting. Light: 2–3.	

Azo Alizarine Bordeaux W (DH) *Osfachrome Bordeaux* B (OeV) Sodium salt of benzene-1:4-disazo-salicylic-acid-α-naphthol-4-sulphonic acid. No. 341 (291)	*Azo Alizarine Bordeaux W (DH)*— A brown powder. H_2O: magenta-red solution. HCl: magenta-red precipitate. NaOH: violet-red solution. H_2SO_4: pure blue solution, magenta-red precipitate on dilution. Dyes chrome-mordanted wool, or wool from an acid bath and after-chromed, fast Bordeaux. Light: 2–3.	
Azo Alizarine Black I (DH) Sodium salt of benzene-1:4-disazo-salicylic-acid-1:8-dihydroxy-naphthalene-3:6-disulphonic acid. No. 342 (292)	A brownish-black powder. H_2O: dark crimson solution. HCl: maroon precipitate. NaOH: violet solution. H_2SO_4: blue solution; violet solution and then maroon precipitate on dilution. Dyes chrome-mordanted wool, or wool from an acid bath and after-chromed, black, fast to light. Light: 2.	
Chrome Fast Yellow G (CAC) (SCI) **Anthracene Yellow** C, C pdr., and paste. (By) (C) Anthracite Yellow S (C) **Acid Alizarine Yellow** RC (MLB) Sodium salt of thiodiphenyl-*p.p*-disazo-bis-salicylic acid. No. 343 (294)	A brownish-yellow paste or powder. H_2O: sparingly soluble, with a light yellowish-brown colour. HCl: yellowish-grey precipitate. NaOH: yellowish-red precipitate. H_2SO_4: dark reddish-violet solution, yellowish-grey precipitate on dilution. Dyes chrome-mordanted wool, or wool from a single bath with metachrome mordant, or wool from an acid or neutral bath and after-chromed, reddish-yellow. Light: 2. Used also in Vigoureux printing and in calico printing with a chromium mordant; also for dyeing silk.	Much used.
Milling Red G (C) Sodium salt of thiodiphenyl-*p.p*-disazo-bis-β-naphthol-6-sulphonic acid. No. 344 (293)	A brownish-red powder. H_2O: orange-red solution. HCl: brown precipitate. NaOH: unaltered. H_2SO_4: reddish-violet solution; orange-red solution and then brown precipitate on dilution. Dyes wool from an acid bath yellowish-red, of good fastness to alkalies and milling, and moderately fast to light. The fastness is improved by after-treatment with chromium fluoride or dichromate. Light: 2–3.	
Diphenyl Fast Black (Gy) Sodium salt of ditolylamine-*p.p*-disazo-*m*-toluylenediamine-7-amino-1-naphthol-3-sulphonic acid. No. 345 (295)	A black powder. H_2O: violet black solution, hot. Alcohol: dark violet solution. HCl to aqueous solution: bluish-black precipitate. NaOH: black precipitate. H_2SO_4: dark blue solution, bluish-black precipitate on dilution. Dyes cotton direct black, moderately fast to light and washing, and not	

	sensitive to acids, or alkalies. Light: 2–3. Only used for dyeing feathers.	
Chlorazol Fast Yellow 5GK (BDC) *Chloramine Fast Yellew* 4GL (S) Naphthamine Pure Yellow L (K) Sodium salt of diphenylurea-*p.p*-disazobissalicylic acid. No. 346 (296)	A greenish-yellow powder. H_2O: sparingly soluble, hot, with a yellow colour. Alcohol: insoluble. HCl to aqueous solution: reddish-brown precipitate. NaOH: orange solution and soluble orange precipitate. H_2SO_4: orange-red solution, bluish-violet precipitate, and then reddish-brown precipitate on dilution. HNO_3: gives a brown spot with a violet rim on the dyed fibre. Dyes cotton direct from a boiling alkaline bath bright lemon-yellow, moderately fast to light. Converted into green to black by mineral acids. Thef astness to washing is increased by after-chroming. Light: 2–3. Used also in calico printing on a chromium mordant. Discharged white by all the usual reagents on cotton.	
Salm Red (B) No longer manufactured. Sodium salt of diphenylurea-*p.p*-disazobis-*a*-naphthylamine-4-sulphonic acid. No. 347.	A brownish-powder. H_2O: orange-yellow solution. HCl: bluish-violet precipitate. NaOH: unaltered, or soluble orange-yellow precipitate. H_2SO_4: magenta-red solution, bluish-violet precipitate on dilution. Dyes cotton direct from an alkaline bath flesh colour to brownish-orange, moderately fast to washing but not fast to light or acids.	
Fast Red (B) Sodium salt of diphenylurea-*p.p'*-disazobis-2-amino-8-naphthol-3:6-disulphonic acid.	A red powder. H_2O: cherry-red solution hot. H_2SO_4: blue solution. HNO_3: blue-black. Dyes cotton direct bright red of excellent fastness to light and acids. Light: 2.	
Benzo Light Yellow 4GL extra (By) Sodium salt of 2:2-dimethoxydiphenylurea-4:4-disazo-bisbenzene-*m*-carboxylic acid. No. 349	*Benzo Fast Yellow 4GL* extra— An orange-yellow powder. H_2O: readily soluble with a yellow colour. HCl: brown precipitate. NaOH: yellow precipitate. H_2SO_4: crimson solution, brown precipitate on dilution. HNO_3: blue. Dyes cotton direct yellow, faster to light than No. 346, but not fast to washing. Light: 1–2. Used also in calico printing. Discharged white by all the usual reagents on cotton.	

Diazol Light Yellow N4J (CN) **Benzo Light Yellow** RL (By) Sodium salt of 2:2-dimethoxy-5.5-dimethyl-diphenylurea-4:4-disazo-bis-benzene-*m*-carboxylic acid. No. 349a. The statement in Colour Index is erroneous. Another Benzo Light Yellow has the composition: Acid IV → *m*-toluidine ($COCl_2$).	*Benzo Light Yellow* RL— A yellow powder. H_2O: readily soluble, with an orange-yellow colour. HCl: violet solution. NaOH: orange solution. H_2SO_4: crimson solution, bluish-violet precipitate on dilution. HNO_3: blue. Dyes cotton direct yellow, faster to light than No. 346, but not fast to washing. Light: 1–2. Used also in calico printing. Discharged white by all the usual reagents on cotton.	
Heligoland Yellow (NI) Sodium salt of diphenylthiourea-4:4-disazo-bis-phenol. No. 350.	A brown powder. H_2O: yellow solution. HCl: brown precipitate. NaOH: redder solution. H_2SO_4: orange-red solution, brown precipitate on dilution. Light: 2–3. Dyes cotton direct yellow.	Not manufactured.
Salmon Red (*NI*) Sodium salt of diphenylthiourea-4:4-disazo-bis-α-naphthylamine-4-sulphonic acid. No. 351	A reddish-brown powder. H_2O: orange-red solution. HCl: bluish-violet precipitate. NaOH: unaltered. H_2SO_4: magenta-red solution, bluish-violet precipitate on dilution. Dyes cotton direct orange-red. Light: 3.	Scarcely used.
Para Fast Brown GR (By) Sodium salt of 3:3-disulphodiphenylurea-4:4-disazo-bis-*m*-phenylenediamine. No. 352.	A glistening dark bronze powder. H_2O: sparingly soluble cold, soluble with a brown colour on boiling. HCl: reddish-brown precipitate. NaOH: orange-brown solution and precipitate. H_2SO_4: bluish-red solution, reddish-brown precipitate on dilution. Dyes cotton direct and developed with diazotised *p*-nitroaniline very bright brown, fast to light and washing. Light: 3. Used also in calico printing. Discharged white by hydrosulphite on cotton.	
Para Fast Brown GK, RK, (By) Sodium salt of diphenylurea-3:3-disazo-*m*-phenylenediamine-*m*-phenylenediamine-sulphonic acid. No. 352a.	A brown to dark grey crystalline powder. H_2O: sparingly soluble cold, soluble with a brown colour on boiling. HCl: reddish to brown precipitate. NaOH: red to brown solution. H_2SO_4: brownish-red solution, reddish to brown precipitate on dilution. Dyes cotton direct and developed with diazotised *p*-nitroaniline, brown, fast to light and washing. Light: 2–3. Discharged white by hydrosulphite on cotton.	
Chlorazol Fast Pink BK (BDC)	*Benzo Fast Pink 2BL (By)*— A brownish-red powder.	

Pontamine Fast Pink BL (DuP) **Benzo Fast Pink** 2BL (By) Sodium salt of 3:3-disulphodiphenylurea-4:4-disazo-bis-2-amino-8-naphthol-6-sulphonic acid. No. 353 (297)	H_2O: crimson-red solution. HCl: reddish-violet solution. NaOH: yellower solution. H_2SO_4: blue solution, soluble black precipitate on dilution. HNO_3: blue. Dyes cotton direct bright pink, fast to light and washing, and of good fastness to alkalis. Light: 2–1. Used also in calico printing. Discharged moderately white by hydrosulphite on cotton, but the best white discharges are obtained in presence of leucotrope.	
Brilliant Benzo Fast Violet 4BL, 5RH (By) **Benzo Fast Eosine BL (By)** Sodium salt of 3:3-disulphodiphenylurea-4:4-disazo-2-amino-6-sulpho-8-naphthol-6-phenylamino-1-naphthol-3-sulphonic acid. No. 353a.	*Brilliant Benzo Fast Violet 4BL*— A slate-grey powder. H_2O: violet solution. HCl: blue solution. NaOH: violet solution. H_2SO_4: dark blue solution. HNO_3: blue solution. Dyes cotton direct level bright violet of excellent fastness to light. *Brilliant Benzo Fast Violet 5RH*— A dark violet powder. H_2O: red solution. HCl: violet solution. NaOH: red solution. H_2SO_4: dark violet solution. HNO_3: blue. Dyes cotton direct level bright violet of excellent fastness to light and ironing. **Benzo-Fast Eosine BL**— A reddish-brown powder. H_2O: red solution. $\lambda = \frac{505.8}{508.0}$ HCl: brown solution. NaOH: red solution. H_2SO_4: red solution. HNO_3: brown-black. Dyes cotton direct very clear Eosine shades of excellent fastness to light, ironing, rubbing, alkalies and acetic acid. Light: 2.	
Milling Red *R (WDC)* Sodium salt of diphenylmethane-4:4-disazo-bis-β-naphthol-3:6-disulphonic acid. No. 354 (298)	A red powder. H_2O: bright red solution. Alcohol: insoluble. HCl to aqueous solution: unaltered. NaOH: duller solution. H_2SO_4: Bordeaux red solution; bluish-red solution on dilution. HNO_3: red. Dyes wool from an acid bath bright red, fast to light and milling. Moderately bright lakes are obtained with barium salts. Little used. Light: 2–3.	
Milling Scarlet B, 6B, (MLB) Sodium salt of 2:2-dimethyldiphenylmethane-4:4-disazo-bis-α-naphthol-5-	A brownish-red powder. H_2O: red solution. Dyes wool from an acetic acid bath scarlet. Level-dyeing 5; relation to cotton 2–3; relation to silk 3–4; Light: 2–3.	

sulphonic acid. No. 355	Used particularly for dyeing bright cochineal scarlet on flannel.	
Cinnabar Scarlet BF (BK) Sodium salt of 2:5:2:5-tetramethyl-diphenylmethane-4:4-disazo-bis-β-naphthol-3:6-disulphonic acid. No. 356 (299)	A red powder. H_2O: bluish-red solution. Alcohol: insoluble. HCl to aqueous solution: unaltered. NaOH: yellower solution. H_2SO_4: bluish-red solution, unaltered on dilution. HNO_3: blue-red. Dyes cotton direct scarlet from an alkaline bath. Light: 3. Used for the manufacture of lakes.	Scarcely used.
Brilliant Carmine L (BDC) *Cotton Ponceau* (BK) Sodium salt of 2:5:2:5-tetramethyl-triphenylmethane-4:4-disazo-bis-β-naphthol-3:6-disulphonic acid. No. 357 (300)	A reddish-brown powder. H_2O: dark red solution. Alcohol: insoluble. HCl to aqueous solution: unaltered. NaOH: deeper red solution. H_2SO_4: bluish-red solution; red solution on dilution. HNO_3: *id.* Dyes cotton direct red from an alkaline bath. Used for the manufacture of lakes. Light: 3.	
Hessian Bordeaux (MC) (L) Sodium salt of 2:2-disulphostilbene-4:4-disazo-bis-α-naphthylamine. No. 358	A greenish glistening powder. H_2O: deep red solution. Alcohol: red solution. HCl to aqueous solution: blue precipitate. NaOH: red precipitate. H_2SO_4: bluish-violet solution; bluish-violet precipitate on dilution. HNO_3: *id.* Dyes cotton direct Bordeaux red; suitable for diazotisation and development on the fibre. Light: 2–3.	Scarcely used.
Direct Purple 146 (SCI) *Hessian Purple* N (MC) (A) (By) (L) Sodium salt of 2: disulphostilbene-4 : 4-disazo-bis-β-naphthylamine. No. 359 (301)	A brownish-red powder. H_2O: cherry-red solution. λ = not distinct. HCl: bluish-black precipitate. Dilute acetic acid: violet-black precipitate. NaOH: soluble red precipitate. H_2SO_4: blue solution, bluish-black precipitate on dilution. HNO_3: *id.* Dyes cotton direct from a soap bath bluish-red, moderately fast to washing and alkalies, but not fast to light or air, and sensitive to acids. It is faster on wool than on cotton. Used also for dyeing wool moderately fast crimson. Light: 2–3. Satisfactory white discharges cannot be obtained with any of the usual reagents.	
Brilliant Hessian Purple (MC) (A) (By) (L)	A dark red powder. H_2O: orange-red solution. λ = not distinct.	

Sodium salt of 2:2-disulphostilbene-4:4-disazo-bis-β-naphthylamine-6-sulphonic acid. No. 360 (302)	Alcohol: sparingly soluble. HCl to aqueous solution: bluish-black precipitate. NaOH: soluble carmine-red precipitate. H_2SO_4: blue solution, bluish-black precipitate on dilution. HNO_3: *id.* Dyes cotton direct bluish-red, similar to other Hessian Purples. Light: 2–3. Satisfactory white discharges cannot be obtained with any of the usual reagents.	
Hessian Purple B (MC) (A) (By) (L) Sodium salt of 2:2-disulphostilbene-4:4-disazo-bis-β-naphthylamine-6 and 7-sulphonic acid. No. 361	A brown powder. H_2O: cherry-red solution. HCl: brownish-black precipitate. Dilute acetic acid: darker solution. NaOH: reddish-violet precipitate, soluble in water. H_2SO_4: violet solution, brown precipitate on dilution. HNO_3: blue-red. Dyes cotton direct from a soap bath bluish-red, less sensitive to acids than No. 359. Light: 2–3. Satisfactory white discharges cannot be obtained with any of the usual reagents.	
Hessian Purple D (MC) (A) (By) (L) Sodium salt of 2:2-disulphostilbene-4:4-disazo-bis-β-naphthylamine-5-sulphonic acid. No. 362.	A black powder. H_2O: orange-red solution. λ = not distinct. HCl: brown precipitate. Dilute acetic acid: unaltered. NaOH: bluer solution. H_2SO_4: violet solution; brown solution and brown precipitate on dilution. HNO_3: blue. Dyes cotton direct bluish-red from a soap bath. Satisfactory white discharges cannot be obtained with any of the usual reagents.	Scarcely used.
Hessian Violet (MC) (A) (By) (L) Sodium salt of 2:2-disulphostilbene-disazo-α-naphthylamine-β-naphthol. No. 363	A black powder. H_2O: reddish-violet solution. λ = not distinct. HCl: blue precipitate. Dilute acetic acid: bluish-violet solution. NaOH: bluish-violet solution. H_2SO_4: blue solution, violet precipitate on dilution. HNO_3: blue. Dyes cotton direct from a soap bath violet, not fast to light and rather sensitive to acids. Light: 2–3. Satisfactory white discharges cannot be obtained with any of the usual reagents.	
Paper Yellow 3G (BDC) (B) Brilliant Yellow 3G, C, ex. conc. Y, No. 10, (L B H) (AAP) (CD) (S) (MC) (StD) (ICA)	A light-brown powder. In water partial absorption in blue and violet; after addition of potassium hydroxide, λ = about 492.5. H_2O: reddish-yellow solution. HCl: violet precipitate. NaOH: yellowish-red solution H_2SO_4: reddish-	

(A) (By) (GrE) (L), (B D C) (N A C) (NCW) (Sch) (SCI) Renol Brilliant Yellow conc. (tM) Sodium salt of 2:2-disulphostilbene-4:4-disazo-bis-phenol. No. 364 (303)	violet solution, violet precipitate on dilution. HNO_3: blue. Dyes cotton direct from an acetic acid salt bath golden-yellow, very fast to light and fast to dilute acids. It is reddened by alkalies, loose to soaping, and is sensitive to copper. Light: 2–1. Used largely for colouring paper and for the manufacture of Chrysophenine G (No. 365); also as an indicator for alkalies. Satisfactory white discharges can be obtained with rongalite. **A most important paper yellow.**	
Chrysophenine G (BDC) (LBH) (S) (MC) (StD) (FB) (ICA) (A) (By) (K) (L) Diphenyl Chrysoine 3G (Gy) Aurophenine O (MLB) Sodium salt of 2:2-disulphostilbene-4:4-disazo-bis-phenetole. No. 365 (304)	An orange-yellow powder. In water: partial absorption in blue and violet; after addition of acid $\lambda = 527.3$. H_2O: sparingly soluble cold, readily soluble hot with an orange-yellow colour. HCl to hot aqueous solution: brown to bluish-green precipitate. Dilute acetic acid: scarcely altered. NaOH: yellow solution and flocculent orange precipitate. H_2SO_4: reddish-violet solution, blue precipitate on dilution. HNO_3: Blue. HCl conc.: pure blue. Dyes cotton direct, wool from a neutral or acid bath, and silk from an acetic acid or neutral bath, golden-yellow. Used very largely for dyeing all fibres; also in printing. Discharged moderately white by hydrosulphite on cotton, but the best white discharges are obtained in presence of leucotrope. One of the most important yellow dyes. Light: 2-1.	
Hessian Yellow (A) (By) (L) Sodium salt of 2:2-disulphostilbene-4:4-disazo-bis-salicylic acid. No. 366 (305)	An ochre-yellow powder. H_2O: brownish-yellow solution. HCl: black precipitate. Dilute acetic-acid: scarcely altered. NaOH: cherry-red solution. H_2SO_4: reddish-violet solution, black precipitate on dilution. HNO_3: blue. Dyes cotton direct from a neutral or acid bath yellow, very fast to light, but sensitive to alkalies, soap and copper. Light: 2–1.	
Congo GR (A) (By) Sodium salt of diphenyl-diazoamino-*m*-sulpho-benzene-azo-α-naphthyl-	A brown powder. H_2O: brownish-red solution. HCl: blue precipitate. Dilute acetic acid violet precipitate. NaOH: unaltered. H_2SO_4: blue solution, blue precipitate on dilution. HNO_3: blue.	

amine-4-sulphonic acid. No. 367	Dyes cotton direct from a soap bath red, very sensitive to acids. Used as an *indicator* for mineral acids. Used also in calico printing. Bottom for aniline black. Discharged white by hydrosulphite on cotton.	
Pyramine Orange 3G (B) Sodium salt of diphenyl-disazo-disulpho-*m*-phenylenediamine-nitro-*m*-phenylenediamine. No. 368 (306)	A reddish-brown powder. In water: partial absorption in blue and violet. H_2O: sparingly soluble, with a yellowish-red colour. Alcohol: sparingly soluble, with a yellowish-green colour and a slight brownish-red fluorescence. HCl to aqueous solution: unaltered. NaOH: unaltered. H_2SO_4: yellowish-red solution, unaltered on dilution. HNO_3: decomposition. Dyes cotton direct, or half-silk from a faintly alkaline bath, or wool from a faintly acid bath, yellowish-orange, fast to milling. Light: 2–3. Used largely for dyeing wool, unions and half-silk. Satisfactory white discharges cannot be obtained with any of the usual reagents.	
Pyramine Orange 2*R* (*B*) Sodium salt of diphenyl-disazo-3:6-disulpho-β-naphthylamine-nitro-*m*-phenylenediamine. No. 369 (314)	A reddish-brown powder. H_2O: sparingly soluble with a yellowish-red colour. Alcohol: sparingly soluble, with a yellow colour and a brownish-red fluorescence. HCl: to aqueous solution: unaltered. NaOH: unaltered. H_2SO_4: blue solution; yellowish-red solution on dilution. HNO_3: blue and decomposition. Dyes cotton direct, or half-silk from a faintly alkaline bath, or wool from a neutral or faintly acid bath, reddish-orange of good fastness to washing, alkalies, milling, stoving and ironing. Light: 3. Used largely for dyeing wool, unions and half-silk. Satisfactory white discharges cannot be obtained with any of the usual reagents.	
Congo Red W, R, R extra SD, N, B, (ACC) (JBS) (JWL) (LDC) (Lev) (SCC) (AAP) (DuP) (MOH) (Sch) (S) (SCI) (LJ) (MO) (RF) (VSt) (VStG) (ICA) (JDC) (BK)	A reddish-brown powder. H_2O: red solution. λ: 497.0; in acid: $\lambda = 647.0$. HCl: blue precipitate. Dilute acetic acid: bluish-violet precipitate. NaOH: reddish-brown precipitate, soluble in water. H_2SO_4: blue solution, blue precipitate on dilution. HNO_3: blue. Dyes cotton direct red.	

(By) (GrE) (L) (OeV) (BDC) (H) (NCW) (LBH) (SCC) (CN) (K) Cotton Red C, 4B, B, conc. (SCI) (StD) (GrE) (K) (tM) Congo (A) Dianil Red R (MLB) No. 370 (307) Sodium salt of diphenyl-disazo-bis-α-naphthylamine-4-sulphonic acid.	Dyes wool red from a neutral bath. Level-dyeing 5; relation to cotton 5; relation to silk 3–4. Light: 4. The sensitiveness of the dyed shade to acids may be decreased by after-treatment with Solidogen (MLB), *i. e.* the hydrochlorides of aminobenzyl bases. $(H_3C).C_6H_4.NH.CH_2C_6H_3(CH_3)NH_2$: prepared by the action of formaldehyde on a mixture of *o*- and *p*-toluidine. Used also in calico printing, also for the preparation of an indicator paper which is coloured blue by mineral acids. Discharged fairly white by hydrosulphite on cotton.	
Diazo Black *B (By)* *No.* 371 (308) *Constitution uncertain.*	A black powder (mixture of a blackish-blue and a red dye). H_2O: violet solution. HCl: blue solution. NaOH: blue precipitate. H_2SO_4: blue solution, unaltered on dilution. Dyes cotton direct from a faintly alkaline bath containing Glauber's salt navy-blue of good fastness to acids and alkalies, moderately fast to washing, but not very fast to light. The dyeings are converted by diazotisation and development with β-naphthol into blue-black, or with *m*-toluylenediamine into jet black, fast to acids, alkalies and washing. Used also for dyeing unions and half-silk by the single bath process. Satisfactory white discharges cannot be obtained on Diazo Black B with any of the usual reagents.	
Glycine Corinth (Ki) Sodium salt of diphenyl-disazobis-α naphthylglycine No. 372 (310)	A brown powder. H_2O: bluish-red solution. Alcohol: red solution. HCl to aqueous solution: violet precipitate. NaOH: red precipitate. H_2SO_4: blue solution, violet precipitate on dilution. HNO_3: violet. Dyes cotton direct currant-red from an alkaline soap bath.	
Glycine Red (Ki) Sodium salt of diphenyl-disazo-α-naphthylglycine-α-naphthylamine-4-sulphonic acid. No. 373 (309)	Used as a photographic sensitiser. A reddish-brown powder. H_2O: yellowish-red solution. Alcohol: red solution. HCl to aqueous solution: violet precipitate. NaOH: yellowish-red precipitate. H_2SO_4: blue solution, violet precipitate on dilution. HNO_3: red. Dyes cotton direct red from an alkaline soap bath.	

	Used as a photographic sensitiser. Not used as a textile dyestuff.	
Orange TA (JBS) (A) (By) (L) *Erie Orange* 2R (NAC) *Direct Orange* A (ICA) Sodium salt of diphenyl-disazo-4-sulpho-α-naphthylamine cresol. No. 374 (311)	A reddish-brown powder. H_2O: reddish-orange solution. HCl: violet-blue precipitate NaOH: redder solution. H_2SO_4: blue solution, blue precipitate on dilution. HNO_3: blue. Dyes cotton direct level reddish-orange. Used chiefly for dyeing unions, less for dyeing wool and silk. Light: 4. Satisfactory white discharges cannot be obtained with any of the usual reagents.	
Congo Corinth GW, G, (BDC) (JBS) (Lev) (GCC) (S) (SCI) (ICA) (A) (B) (BK) (By) (L) Congo Corinth G, (LDC) (CD) (GCC) Sodium salt of diphenyl-disazo-4-sulpho-α-naphthylamine-α-naphthol-4-sulphonic acid. No. 375 (312)	A greenish-black powder. H_2O: magenta-red solution. HCl: violet-black precipitate. Dilute acetic acid-violet solution. NaOH: soluble cherry-red precipitate. H_2SO_4: blue solution, violet precipitate on dilution. HNO_3: *id.* Dyes cotton direct brownish-violet. Satisfactory white discharges cannot be obtained with any of the usual reagents. The first mixed disazo dye of the Congo series to be placed on the market. Is optically a mixture, according to Formanek.	
Congo Rubine A, B (BDC) (JBS) (Lev) (A) (BK) (By) (L) (OeV) (S) (K) Cotton Rubine (B) Alkali Rubine (WDC) Sodium salt of diphenyl-disazo-8-supho-β-naphthol-α-naphthylamine-4-sulphonic acid. No. 376 (313)	A greenish crystalline powder. H_2O: cherry-red solution. Alcohol: bluish-red solution. HCl to aqueous solution: pure blue precipitate. NaOH: violet-red precipitate. H_2SO_4: pure blue solution, blue precipitate on dilution. HNO_3: *id.* Dyes cotton direct bluish-red. Used also for dyeing wool and silk, on which it is faster than on cotton; also for dyeing unions. It is a cheap and useful dye. Satisfactory white discharges cannot be obtained with any of the usual reagents. A mixture.	
Congo Orange G (A) (By) (L) Sodium salt of diphenyl-disazo-3:6-disulpho-β-naphthylamine-phenetole. No. 377 (315) Polar orange No. 377a. as 377, but esterified with *p*-toluolsulphochloride.	A brownish-red powder. H_2O: orange-yellow solution. Alcohol: sparingly soluble, with an orange-yellow colour. HCl to aqueous solution: brown precipitate. NaOH: unaltered. H_2SO_4: blue solution; reddish-violet solution and then brown precipitate on dilution. HNO_3: blue-brown. Dyes cotton direct level orange. Used for dyeing cotton wool, silk, unions and half-silk. Light: 2–3. Discharged white by all the usual reagents on cotton.	

	Polar Orange: Is no longer a cotton dye, but is used as a wool dye, fast to milling. Light: 2.	
Brilliant Congo G (Lev) (A) (By) (L) Brilliant Congo Red G (RF) Sodium salt of diphenyl-disazo-6-sulpho-β-naphthylamine-β-naphthylamine-3:6-disulphonic acid. No. 378 (316)	A brown powder. H_2O: brownish-red solution. HCl: brownish-violet precipitate. Dilute acetic acid: bluer solution. NaOH: little change. H_2SO_4: blue solution, violet precipitate on dilution. Dyes cotton, direct level red from a soap bath. Dyes wool, from a neutral bath red, fast to washing and stoving, and moderately fast to light. Light: 4–3.	
Oxamine Orange G (R) Sodium salt of diphenyl-disazo-phenol-*m*-toluylenediamine-oxamic acid. No. 379	A reddish-brown powder. H_2O: soluble hot, insoluble cold. Alcohol: soluble. HCl to aqueous solution: brownish-red precipitate. NaOH: darker solution. H_2SO_4: violet solution, reddish-brown precipitate on dilution. Dyes cotton direct orange, which can be diazotised and developed on the fibre. Light: 3–4.	
Pyramidol Brown BG, (LDC) (FA) Sodium salt of diphenyl-disazo-bis-resorcinol. No. 380 (317)	A dark brown powder. (Sodium salt.) H_2O: orange-brown solution. Alcohol: orange solution. HCl to aqueous solution: brown precipitate. NaOH: Bordeaux red solution. H_2SO_4: reddish-violet solution, brown precipitate on dilution. HNO_3: purple. Dyes cotton direct red converted into deep brown, fast to washing, by development on the fibre with a diazonium compound. Light: 3–4.	
On the Fibre— **Benzidine Puce** (MLB) Benzidine— Fast Corinth B base (GrE) Diphenyl-disazo-bis-β-naphthol. No. 381 (318)	*In substance:* a dark reddish-brown powder which separates from glacial acetic acid in a red-brown crystalline powder, M. P. 272°. $\lambda = 640.55$ and $\lambda = 595.10$. H_2SO_4: blue solution. HNO_3: purple. *On the Fibre:* Dyes cotton, padded with β-naphthol and developed with tetrazotised benzidine in presence of sodium acetate or chalk, dark garnet or puce. The shade may be darkened by mixing α-naphthol with the β-naphthol. The use of Naphthol AS in the place of β-naphthol yields a deep chocolate shade. Light: 2. Used also in calico printing. Discharged by hydrosulphite on cotton, but the production of satisfactory whites is often difficult.	

Dianol Fast Claret (Lev) **Chloramine Red** B, 3B, (S) **Benzo Scarlet** **BC** (By) Sodium salt of diphenyl-disazo-6:8-disulpho-β-naphthol-phenetole. No. 382 (319) 3B with β-acid and *o*-tolidine. Diamine Scarlet B; 2B	A reddish crystalline powder. H_2O: scarlet-red solution. λ = not distinct. Alcohol: red solution. HCl to aqueous solution: reddish-brown solution or precipitate. NaOH: yellower solution and red soluble precipitate. H_2SO_4: violet solution; reddish-brown solution and precipitate on dilution. Dyes cotton direct from an alkaline bath, and wool and silk from an acid or neutral bath, scarlet-red. Not sensitive to acids but not fast to light on cotton. Fast to light and of good fastness to washing and milling on wool. Fast to light, acids and alkalies on silk. Light: 2–3. Used also in calico printing. Discharged white by hydrosulphite on cotton.	Important.
Oxamine Scarlet *B* (*R*) Sodium salt of diphenyl-disazo-4-sulpho-α-naphthylamine-*m*-phenylene-diamine-oxamic acid No. 383	A reddish-brown powder. H_2O: red solution hot. λ = not distinct. Alcohol: sparingly soluble. HCl to aqueous solution: violet-black precipitate. NaOH: unaltered. H_2SO_4: pure blue solution, violet precipitate on dilution. HNO_3: blue. Dyes cotton direct scarlet-red, which can be diazotised and developed on the fibre.	Scarcely used.
Oxamine Red B (R) Sodium salt of diphenyl-disazo-4-sulpho-α-naphthol-*m*-phenylenediamine-oxamic acid. No. 384	A black powder. H_2O: red solution. Alcohol: red solution. HCl to aqueous solution: brownish-red precipitate. NaOH: clear cherry-red solution. H_2SO_4: pure blue solution, bluish-red precipitate on dilution. Dyes cotton direct bluish-red, which can be converted into darker shades by diazotisation and development on the fibre. Light: 3.	
Bordeaux extra C extra, COV, BL extra (ACC) (W) (By) (AJ) (A) (tM) New Bordeaux L (By) Azidine Violet R (CJ) Sodium salt of diphenyl-disazo-bis-β-naphtol-8-sulphonic acid. No. 385 (320)	A brown powder. H_2O: Bordeaux red solution. λ = 543·5 (extra). HCl: violet precipitate. Dilute acetic acid: unaltered. NaOH: yellower solution. H_2SO_4: violet solution, violet precipitate on dilution. Dyes wool Bordeaux red from an acid bath, and cotton direct violet. Light: 3.	

Heliotrope 2B (Lev) (A) (By) (L) Sodium salt of diphenyl-disazo-8-sulpho-β-naphthol-α-naphthol-4:8-disulphonic acid. No. 386 (321)	A dark grey powder. H_2O: reddish-violet solution. $\lambda = 539.0$ Alcohol: bluish-red solution. HCl to aqueous solution: bluish-violet precipitate. NaOH: redder solution. H_2SO_4: blue solution, reddish-violet solution and then reddish-violet precipitate on dilution. Dyes cotton direct from a faintly alkaline bath level violet, moderately fast to washing and alkalies, but not very fast to light, chlorine and ironing, and rendered bluer by dilute acids. Light: 3–4. Used also in calico printing. Discharged white by hydrosulphite on cotton.	
Chlorazol Violet WBX (BDC) Direct Violet R (CCC) Erie Violet BW (NAC) Direct Brilliant Violet R conc. (NCW) Sodium salt of diphenyl-disazo-3:6:8-trisulpho-α-naphthol-β-naphthol. No. 387 (322)	A dark bronzy powder. In water: $\lambda = 556.0$. H_2O: violet solution. Alcohol: sparingly soluble, with a reddish-violet colour. HCl to aqueous solution: bluish-violet precipitate. NaOH: reddish-violet solution. H_2SO_4: greenish-blue solution, violet precipitate on dilution. Dyes cotton direct violet, moderately fast to alkalies and of good fastness to washing. Light: 4. Used also for dyeing unions and in calico printing. Discharged white by hydrosulphite on cotton.	
Chlorazol Violet R (BDC) Paramine Violet R (LBH) Benzo Violet R (A) (By) Sodium salt of diphenyl-disazo-4-sulpho-α-naphthol-α-naphthol-3:6-disulphonic acid. No. 388	A violet powder. H_2O: reddish-violet solution. λ = not distinct. HCl: soluble reddish-violet precipitate. NaOH: red solution. H_2SO_4: blue solution; violet solution and then reddish violet precipitate on dilution. HNO_3: blue. Dyes cotton direct from a neutral salt bath violet, moderately fast to washing and acids, but not very fast to light and reddened by alkalies. Used also for dyeing half-silk, the silk of which is only stained a pale reddish-shade; also in calico printing. Light: 4–3. Discharged white by hydrosulphite on cotton.	
Dianil Blue 4R (MLB) Sodium salt of diphenyl-disazo-6-sulpho-β-naphthol-1:8-dihydroxy-naphthalene-3:6-disul-	A black powder with a bronzy lustre. H_2O: violet solution. λ: 558.0 HCl: soluble reddish-violet precipitate. NaOH: red solution. H_2SO_4: blue solution; violet solution and then reddish-violet precipitate on dilution. HNO_3: violet.	

phonic acid. No. 389)	Dyes cotton direct rather dull violet. The fastness to washing is increased by after-treatment with dichromate. Light: 3–4. Satisfactory white discharges cannot be obtained with hydrosulphite.	
Dianil Blue R (JBS) (MLB) Direct Brilliant Blue GR (PCC) Sodium salt of diphenyl-disazo-bis-1:8-dihydroxynaphthalene-3:6-disulphonic acid. No. 390 (323)	A grey-blue powder. H_2O: blue solution. $\lambda = 589.5$ (H_2O) HCl: little change. NaOH: redder solution. H_2SO_4: greenish-blue solution: reddish-blue solution on dilution. Dyes cotton direct blue. The fastness to washing is increased by after-treatment with dichromate, and the fastness to light is increased by a mild after-treatment with copper sulphate. Light: 3–4. Used also for dyeing unions and half-silk; also in calico printing. Discharged white by hydrosulphite on cotton.	
Chicago Blue 4R (A) Benzo Blue 4R (By) Diamine Blue C4R (C) Sodium salt of diphenyl-disazo-8-sulpho-β-naphthol-8-amino-1-naphthol-5-sulphonic acid. No. 391 (324)	A violet powder. H_2O: violet-blue solution. Alcohol: reddish-violet solution. HCl to aqueous solution: blue solution. NaOH: reddish-violet solution. H_2SO_4: blue solution, violet precipitate on dilution. Dyes cotton direct level blue. Light: 3–4. Used also in calico printing. Discharged white by hydrosulphite on cotton.	
Columbia Blue R (A) Benzo Red-Blue R (By) Diamine Blue LR (C) Sodium salt of diphenyl-disazo-3:8-disulpho-α-naphthol-8-amino-1-naphthol-5-sulphonic acid. No. 392 (325)	Many are *mixtures*. A violet powder. H_2O: bluish-violet solution. $\lambda = 567$. Alcohol: insoluble. HCl to aqueous solution: blue precipitate. NaOH: blue solution. H_2SO_4: blue solution, violet precipitate on dilution. Dyes cotton direct level blue. Silk is only slightly stained when dyed in soap bath.	
Direct Violet RN, O, B. (CAC) (SCI) (StD) (JDC) Oxamine Violet (B) Benzo Violet O (By) *Naphthamine Violet* *BE (K)* Dianil Violet	A dark powder with a faint greenish lustre. H_2O: reddish-violet solution. λ = not distinct. Alcohol: sparingly soluble with a reddish-violet colour. HCl to aqueous solution: violet precipitate. NaOH: violet precipitate. H_2SO_4: pure blue solution; violet solution and then violet precipitate on dilution. HNO_3: blue-red.	

BE (MLB) Sodium salt of diphenyl-disazo-bis-6-amino-1-naphthol-3-sulphonic acid. No. 393 (326)	Dyes cotton direct reddish-violet from an alkaline bath. The direct shade is converted by diazotisation on the fibre and development with β-naphthol into navy blue, or with α-naphthol into a redder blue, or with ethyl-β-naphthylamine into a greener blue, or with *m*-phenylenediamine into brown. Not sensitive to metals. Used also in calico printing. Satisfactory white discharges cannot be obtained with hydrosulphite.	
Direct Violet K, N, R, (AJ) (NCW) (SCI) (MC) (Sch) Columbia Violet R (A) Benzo Fast Violet NC (By) Azidine Violet DV (CJ) Naphthamine Violet N, R, (K) (OeV) Dianil Violet H (MLB) Benzamine Violet N (WDC) Sodium salt of diphenyl-disazo-bis-2-amino-8-naphthol-6-sulphonic acid. No. 394 (327)	A black-brown powder. H_2O: reddish-violet solution. λ: points always to a mixture. Alcohol: insoluble. HCl to aqueous solution: violet-black precipitate. NaOH: unaltered. H_2SO_4: greenish-blue solution, reddish-violet precipitate on dilution. HNO_3: violet. Dyes cotton direct violet from a faintly acid or alkaline bath, with addition of Glauber's salt. Dyes wool and silk, from a neutral or faintly alkaline bath, violet, fairly fast to light, potting, milling, acids, alkalies and washing. Light: 2–3. Used also for dyeing unions and half-silk, the cotton of which is dyed more deeply and much bluer than the wool and silk; also in calico printing. Discharged white by hydrosulphite on cotton. The violet most used.	
Dianol Black RO (Lev) Oxamine Black 2R (B) Sodium salt of diphenyl-disazo-bis-7-amino-1-naphthol-3-sulphonic acid. No. 395 (328)	A black powder. H_2O: violet-black solution. Alcohol: sparingly soluble. HCl to aqueous solution: blue precipitate. NaOH: violet solution. H_2SO_4: blue solution, reddish-blue precipitate on dilution. Dyes cotton direct greyish-violet, converted by diazotisation on the fibre and development with *m*-diamines into black (D below), or with β-naphthol into navy blue to blue-black (N below). Light: 3. Used also in calico printing. Discharged moderately white by hydrosulphite on cotton.	
Diamine Brown V (MLy) (C) **Oxamine Brown** B (B) **Dianil Brown** BH (MLB) Sodium salt of di-	A brownish-black powder. H_2O: insoluble cold, brownish-red solution hot. Alcohol: brownish-red solution. HCl to aqueous solution: chocolate-brown precipitate. NaOH: purplish-brown precipitate. H_2SO_4: bluish-violet	

phenyl-disazo-3-sulpho-7-amino-1-naphthol-*m*-phenylenediamine. No. 396 (329)	solution, brown precipitate on dilution. HNO_3: purple. Dyes cotton direct from a faintly alkaline Glauber's salt bath dark violet-brown, moderately fast to light washing, alkalies, and acids, converted by diazotisation on the fibre and development with β-naphthol into violet-brown, and with *m*-phenylenediamine into bluish-brown fast to washing. A deep maroon-brown is obtained by development on the fibre with diazotised *p*-nitroaniline. Light: 3. Satisfactory white discharges cannot be obtained with hydrosulphite.	
Azo Mauve R (GrE) Sodium salt of diphenyl-disazo-α-naphthylamine-8-amino-1-naphthol-3:6-disulphonic acid. No. 397	A dark powder. H_2O: violet solution. $\lambda = 577.0$. HCl: violet precipitate. NaOH: unaltered or soluble violet precipitate. H_2SO_4: blue solution; violet solution on dilution. Dyes cotton from an alkaline soap bath violet-black, converted by diazotisation on the fibre and development with *m*-toluylene-diamine into black, fast to washing. Light: 3–2.	
Zambesi Brown G, GG, (A) Sodium salt of diphenyl-disazo-3:6-disulpho-2:7-diamino-naphthalene-7-amino-1-naphthol-3-sulphonic acid. No. 398 (33)	*Zambesi-Brown G—* A brown powder. H_2O: Bordeaux red solution. Alcohol: brown solution. HCl to aqueous solution: soluble reddish-brown precipitate. NaOH: reddish-brown solution. H_2SO_4: blue solution, reddish-brown precipitate on dilution. Dyes cotton direct level currant-brown, converted into cutch-brown by diazotisation on the fibre and development with *m*-toluylene-diamine. *Zambesi Brown GG—* A brownish-black powder. H_2O: reddish-violet solution. Light: 3. Alcohol: violet solution. HCl to aqueous solution: soluble brownish-violet precipitate. NaOH: reddish-violet solution. H_2SO_4: blue solution, reddish-violet precipitate on dilution. Dyes cotton direct level violet, converted into cutch-brown by diazotisation on the fibre and development with *m*-toluylene-diamine. Used also for dyeing unions and half-silk, the cotton of which is dyed more deeply than the wool and silk.	Scarcely used.
Alkali Dark Brown G, V, (WDC)	*Alkali Dark Brown G—* A dark brown powder.	

Alkali Red Brown RR, 3R, T, (WDC) α-Nitroso-β-naphthol (No. 2). No. 399 (331)	H_2O: violet-red solution. Alcohol: brownish-red solution. HCl to aqueous solution: bluer solution and brown precipitate. NaOH: brighter and yellower solution. H_2SO_4: blue solution, brown precipitate on dilution. HNO_3 : blue. Dyes cotton and unions direct dark brown, moderately fast to washing, rendered fast to washing and alkalies by after-treatment with copper sulphate.	
Benzo Fast Red 9BL (By) *Dianil Garnet* B (MLB) Sodium salt of diphenyl-disazo-3:6-disulpho-β-naphthylamine-2-amino-8-naphthol-6-sulphonic acid. No. 400 (332)	A dark brown powder. H_2O: Bordeaux red solution. λ = 517.c. HCl: blackish-blue precipitate. NaOH: unaltered. H_2SO_4: pure blue solution, blackish-blue precipitate on dilution. HNO_3: black. Dyes cotton direct bluish-red, rendered yellower and faster to light and acids by after-treatment with copper salts. Light: 3–4. Used also for dyeing unions and in calico printing. Discharged white by stannous chloride or hydrosulphite on cotton.	
Direct Black BH, BH, BD, HB, (AJ) (JDC) (LJ) (StD) (L) *Oxamine Black* BHN (B) Sodium salt of diphenyl-disazo-3-sulpho-7-amino-1-naphthol-8-amino-1-naphthol-3:6-disulphonic acid. No. 401 (333)	A greyish-blue powder. H_2O: reddish-blue solution. HCl: violet solution. NaOH: reddish-violet solution. H_2SO_4: blue solution, violet precipitate on dilution. HNO_3: black-blue. Dyes cotton direct blue, converted into navy blue by diazotisation on the fibre and development with β-naphthol (N below) or into black with *m*-phenylenediamine. Light: 3. Used also for dyeing cotton direct cheap navy blue; also in calico printing. Discharged white by hydrosulphite on cotton.	
Diphenyl Blue-Black (Gy) Sodium salt of diphenyl-disazo-3-sulpho-7-ethylamino-1-naphthol-8-amino-1-naphthol-3:6-disulphonic acid. No. 402 (334)	A dark grey powder. H_2O: dark blue solution. Alcohol: almost insoluble. HCl to aqueous solution: violet precipitate. NaOH: dark violet solution. H_2SO_4: blue solution dark violet precipitate on dilution. Dyes cotton direct deep blackish-blue, converted into blue-black by diazotisation on the fibre and development with β-naphthol, or into black with *m*-phenylenediamine. Used also in calico printing. Discharged white by hydrosulphite on cotton.	Not manufactured.
Diphenyl Fast Grey *B conc.* (*Gy*)	A greyish-black powder. H_2O: dark blue solution.	

No. 403. Aniline-cleve acid-cleve acid-γ-acid **Benzo Light Gray** BL Acid IV-α-naphthylamine-Cleve-acid gamma-acid (acid coupling).	Alcohol: insoluble. HCl to aqueous solution: blue precipitate. NaOH: bluish-violet precipitate. H_2SO_4: dull bluish-green solution; dark blue solution and then violet solution and precipitate on dilution. Dyes cotton direct bluish-grey to black, fast to washing, acids, ironing and light. Light: 2–1. Used also for dyeing half-silk, the silk of which is scarcely stained.	
Naphthamine Black RE (K) *Naphthylamine Diazo Black* (K) Sodium salt of di-phenyl-disazo-3:5-disulpho-8-amino-1-naphthol-7-amino-1-naphthol-3-sulphonic acid. No. 404 (335)	*Naphthamine Black* RE— A grey powder. H_2O: navy blue solution. Alcohol: insoluble. HCl to aqueous solution: soluble reddish-violet precipitate. NaOH: reddish-violet solution. H_2SO_4: pure blue solution; reddish-violet solution on dilution. Dyes cotton direct navy blue, converted by diazotisation, on the fibre and development with β-naphthol into blue-black (N below), or with *m*-toluylene-diamineinto black (D below). Light: 2–3.	
Niagara Blue HW (NAC) **Benzocyanine** R (By) Diamine Cyanine R (C) Sodium salt of di-phenyl-disazo-3:6-disulpho-8-amino-1-naphthol-8-amino-1-naphthol-5-sulphonic acid. No. 405 (336)	A blue powder. H_2O: blue solution. $\lambda = 567.0$. Alcohol: insoluble. HCl to aqueous solution: soluble blue precipitate. NaOH: soluble reddish-blue precipitate. H_2SO_4: blue solution; reddish-blue solution on dilution. HNO_3: reddish-blue. Dyes cotton direct reddish-blue, fast to acids, but not fast to light or alkalies. Light: 4. Used also in calico printing. Discharged white by hydrosulphite on cotton.	
Direct Blue 2B, 2BX, 2BL, BR conc. B, V, RF, (ACC) (AJ) (BEL) (CAC) (JCO) (NBC) (SCC) (CCC) (NCC) (SCI) (LJ) (MC) (StD) (VSt) (JWL) (NCC) (NCW) (MC) (StCl) (T) (StD) (ICA) Chlorazol Blue B (BDC) Benzo Blue 2B (By) Triazol Blue 2BX (GrE)	A slate-grey powder. H_2O: violet solution. $\lambda = 600.0$. Alcohol: insoluble. HCl to aqueous solution: violet solution or precipitate. NaOH: reddish-violet solution. H_2SO_4: greenish-blue solution; violet solution on dilution. HNO_3 : violet. Dyes cotton direct, and wool and silk from an acid or neutral bath, blue; silk is dyed more deeply than cotton. In the cold wool is not dyed in alkaline bath. Used also in calico printing. Discharged white by hydrosulphite on cotton.	A very important product.

Sodium salt of diphenyl-disazo-bis-8-amino-1-naphthol-3:6-disulphonic acid. No. 406 (337)		
Naphthamine Blue *2B*, *3B*, *5B*, (*K*) Sodium salt of diphenyl-disazo-bis-8-amino-1-naphthol-3:5-disulphonic acid. No. 407 (338)	A bluish-grey powder. H_2O: violet to blue solution. $\lambda = 599.0$ (2B) $\lambda = 601.5$ (3Bx) Alcohol: insoluble. HCl to aqueous solution: violet to blue precipitates. NaOH: reddish-violet solutions. H_2SO_4: violet to bluish-green solutions; blue solutions and then violet to blue precipitates on dilution. HNO_3: dark blue. Dyes cotton direct from a faintly alkaline bath in which silk is only dyed slightly, or wool and silk from a faintly acid bath, blue. Light: 3–4. *Naphthamine Blue 2B* is an excellent reagent for staining cotton after it has been swollen.	Scarcely used.
Wool Red *G* (*B*) Sodium salt of diphenyl-disazo-6-sulpho-2-amino-8-naphthol-phenol-*o*-sulphonic acid. No. 408	A brownish-red powder. H_2O: red solution. $\lambda = 505.5$. HCl: brown precipitate. NaOH: dark red solution. H_2SO_4: violet solution, brown precipitate on dilution. HNO_3: *id.* Dyes wool from an acid bath bright scarlet-red of excellent fastness to washing, milling, acids and alkalies, and moderately fast to light; the shade is little altered by after-chroming. Light: 3–4.	
Brilliant Orange G (A) (By) *Diamine Orange* B (C) Sodium salt of diphenyl-disazo-salicylic-acid-4-amino-2-phenol-5-sulphonic acid. No. 409 (339)	A reddish powder. H_2O: sparingly soluble with a yellowish-brown colour. HCl: violet-brown precipitate. NaOH: redder solution. H_2SO_4: reddish-violet solution, brown precipitate on dilution. HNO_3: violet. Dyes cotton direct level orange. The shade is converted into brown by after-treatment with copper salt. Light: 3–4. Used also in calico printing. Satisfactory white discharges cannot be obtained with hydrosulphite in the case of full shades, but moderate whites are obtained on pale shades.	
Direct Chrysamine G, J, (AJ) (StD) *Chrysamine* G, K, J, (H) (JBS) (LDC) (Lev) (AAP)	A yellowish-brown powder or yellow paste. H_2O: very sparingly soluble, with a brownish-yellow colour. HCl: brown precipitate. Dilute acetic	

(MOH) (S) (SCI) (LJ) (MI) (StD) (JDC) (A) (By) (L) (OeV) (tM) (S) (StCl) Flavophenine (B) Azidine Yellow G (CJ) Sodium salt of diphenyl-disazo-bis-salicylic acid. No. 410 (342)	acid: brown precipitate. NaOH: reddish-brown solution and soluble orange-red precipitate. H_2SO_4: reddish-violet solution, brown precipitate on dilution. HNO_3: red. Dyes cotton direct level yellow from a soap bath. Light: 2–3. Used also for cream shades in calico printing. Discharged moderately white by hydrosulphite on cotton. The first yellow substantive dye.	Little used.
Cresotine Yellow G (JBS) (A) (By) GrE (MLB) Erie Yellow KM (NAC) Direct Yellow CR (SCI) Sodium salt of diphenyl-disazo-bis-*o*-cresol-carboxylic acid. No. 411 (351)	A yellowish-brown powder. H_2O: yellow solution. HCl: flocculent brownish-yellow precipitate. Dilute acetic acid: flocculent brownish-yellow precipitate. NaOH: yellowish-red solution or precipitate. H_2SO_4: reddish-violet solution, bluish-violet precipitate and then greenish-yellow precipitate on dilution. HNO_3: red. Dyes cotton direct yellow. Light: 2–3. Used also in calico printing. Discharged white by hydrosulphite on cotton.	Little used.
Cloth Orange (LDC) (FA) (By) (L) Sodium salt of diphenyl-disazo-salicylic-acid-resorcinol. No. 412	A reddish-brown powder. H_2O: yellowish-brown solution. Alcohol: yellowish-brown solution. HCl to aqueous solution: brown precipitate. NaOH: red solution, or, if concentrated, red precipitate. H_2SO_4: reddish-violet solution, brown precipitate on dilution. HNO_3 on fibre: brown spot with a black rim. Dyes chrome-mordanted wool brownish-orange. Light: 3–4.	
Cloth Brown R, (LDC) (FA) (By) (L) Sodium salt of diphenyl-disazo-salicylic-acid-α-naphthol-4-sulphonic acid. No. 413	A dark brownish-red powder. H_2O: reddish-brown solution. Alcohol: insoluble. HCl to aqueous solution: reddish-brown precipitate. NaOH: faint brown precipitate if concentrated. H_2SO_4: bluish-violet solution, reddish-brown precipitate on dilution. HNO_3: brown-violet. Dyes chrome-mordanted wool from an acid bath brownish-red. Light: 3–4.	
Cloth Brown *G (By)* Sodium salt of diphenyl-disazo-salicylic-acid-2:7-dihydroxy-naphthalene. No. 414	A dark brown powder. H_2O: brown solution. Alcohol: slightly soluble. HCl to aqueous solution: brown precipitate. NaOH: reddish-brown solution. H_2SO_4: reddish-violet solution, brown precipitate on dilution. Dyes chrome-mordanted wool from an acid bath brownish-yellow. Light: 3–4.	

Chlorazol Orange RN (BDC) **Benzo Orange** R (JBS) (LDC) (S) (A) (By) Direct Orange R, 3R, M, (NCW) (StD) (ICA) Sodium salt of di-phenyl-disazo-salicylic-acid-α-naphthylamine-4-sulphonic acid. No. 415 (340)	A brownish-red crystalline powder. H_2O: reddish-yellow solution. Alcohol: almost insoluble. HCl to aqueous solution: reddish-violet solution. NaOH: reddish-yellow precipitate. H_2SO_4: violet-blue solution, greyish-violet precipitate on dilution. HNO_3: dark violet. Dyes cotton direct from an alkaline bath, or chrome-mordanted wool, orange. Light: 3–4. Used also in calico printing. Discharged white by all the usual reagents on cotton.	Fairly important.
Chlorazol Orange 2*R* (*H*) Sodium salt of di-phenyl-disazo-salicylic-acid-β-naphthylamine-7-sulphonic acid. No. 416	Dyes cotton direct from an alkaline bath, or chrome-mordanted wool, bright orange. Light: 3–4.	Little used.
Paramine Fast Bordeaux B (LBH) *Crumpsall Direct Fast Red* R, Y, (Lev) Sodium salt of di-phenyl-disazo-salicylic-acid-β-naphthol-3:6-disulphonic acid. No. 417 (341)	*Crumpsall Direct Fast Red Y*— A blackish-brown powder. λ = not distinct. H_2O: sparingly soluble, with a salmon red colour. HCl: brownish-red precipitate. NaOH: yellow precipitate. H_2SO_4: reddish-violet solution, orange-red precipitate on dilution. Dyes cotton direct brownish-red. Light: 3–4.	
Diamine Nitrazol *G* (*C*) Sodium salt of di-phenyl-disazo-salicylic-acid-1-amino-8-naphthol-4:6-disulphonic acid. No. 418	*Diamine Nitrazol Green G*— A brownish-violet powder. H_2O: reddish-brown solution. HCl: dark bluish-green precipitate. NaOH: bluish-red solution. H_2SO_4: blue solution, dark blue precipitate and then bluish-green precipitate on dilution. Dyes cotton direct dull brownish-violet, converted into green, fast to washing, acids and light, by development in the fibre with diazotised *p*-nitroaniline. The shade thus obtained is considerably faster than that obtained from the corresponding trisazo-dye prepared in substance. Light: 3–2. Used also in calico printing. Discharged white by hydrosulphite on cotton.	Little used.
Direct Fast Red T, F, DT, FB, (AJ) (CD) (NCW) (Sch)	A brownish-red powder. H_2O: red solution. $\lambda = 498.9(H_2O)$. $\lambda = 639.0(H_2SO_4)$ blue-red.	

(S) (SCI) (LJ) (MC) (StD (VSt) (ICA) (StD) (ICA) **Diphenyl Fast Red** B (Gy) Chloramine Fast Red F (S) = Diamine Fast Red F (MLy) (C) Direct Red B (StCl) Benzo Fast Red FC (By) Sodium salt of diphenyl-disazo-salicylic-acid-2-amino-8-naphthol-6-sulphonic acid. No. 419 (343)	Alcohol: red solution. HCl to aqueous solution: brownish-red precipitate. NaOH: soluble reddish-brown precipitate. H_2SO_4: bluish-violet solution, violet precipitate and then brown precipitate on dilution. HNO_3: dark-blue. Dyes wool, from a Glauber's salt bath and after-chromed, yellowish-red. Level-dyeing 5; relation to cotton 4–5; relation to silk 3. Light: 3–2. Dyes cotton direct yellowish-red from an alkaline salt bath. Used also in calico printing and largely for wool (carpets) with chrome. Some brands of this colouring matter are discharged white by hydrosulphite on cotton. The first fast direct red.
Direct Brown M, 3RB, MB, (AJ) (CAC) (SCI) (LJ) (StD) (Sch) (StCl) **Diamine Brown** M (MLy) (C) Sodium salt of diphenyl-disazo-salicylic-acid-7-amino-1-naphthol-3-sulphonic acid. No. 420 (344)	A brown powder. H_2O: reddish-brown solution. HCl: brown precipitate. NaOH: redder solution and soluble reddish-brown precipitate. H_2SO_4: violet solution; brown solution and then brown precipitate on dilution. Dyes cotton direct deep brown from an alkaline Glauber's salt bath and exhausts very rapidly. The fastness is increased by after-treatment with copper sulphate and dichromate (G below), or by diazotisation on the fibre and development with *m*-phenylenediamine (D below), whereby it is converted into violet-brown, or by development with β-naphthol (N below), whereby it is converted into bluish-brown. Dyes wool and silk brown of good fastness. Rendered faster, particularly to milling, by after-treatment with copper sulphate or dichromate. Cotton is dyed more deeply than wool or silk. Light: 3–4. Used also in calico printing. The direct and coppered shades are discharged white by hydrosulphite, but the diazotised and developed shades are unsuitable for discharge printing. One of the most important direct-browns.
Diphenyl Brown RN (Gy) Sodium salt of diphenyl-acid-7-methyl-amino-1-naphthol-3-sulphonic	A blackish-brown powder. H_2O: dark reddish-brown solution. Alcohol: reddish-brown solution. HCl to aqueous solution: brownish-red precipitate. NaOH: brownish-red solution. H_2SO_4: bluish-violet solu-

acid. No. 421 (347)	tion, brownish-red precipitate on dilution. Dyes cotton direct dark reddish-brown of good fastness to acids and alkalies, but of only moderate fastness to light and washing. The fastness to light and washing is increased by after-treatment with dichromate and copper sulphate. Light: 3–4.	Not manufactured.
Diphenyl Brown BN (Gy) Sodium salt of diphenyl-disazo-salicylic-acid-7-dimethylamino-1-naphthol-3-sulphonic acid. No. 422 (348)	A blackish-brown powder. H_2O: dark brown solution. Alcohol: reddish-brown solution. HCl to aqueous solution: Bordeaux red precipitate. NaOH: reddish-brown solution. H_2SO_4: bluish-violet solution, Bordeaux-red precipitate on dilution. Dyes cotton direct dark brown of good fastness to acids and alkalies, but of only moderate fastness to light and washing. The fastness to light and washing is increased by after-treatment with dichromate and copper sulphate. Important product, but not made to much extent.	
Chlorazol Brown B (BDC) **Direct Fast Brown** B (ICA) Sodium salt of diphenyl-disazo-salicyclic-acid-7-phenylamino-1-naphthol-3-sulphonic acid. No. 423 (349)	A blackish-brown powder. H_2O: dark brown solution. HCl: Bordeaux brown precipitate. NaOH: redder solution. H_2SO_4: violet solution; brown solution and precipitate on dilution. Dyes cotton direct dark brown, moderately fast to acids, alkalies, light and washing. Light: 3. Used also in calico printing. Discharged moderately white by hydrosulphite on cotton.	A very interesting product.
Oxamine Maroon (B) Sodium salt of diphenyl-disazo-salicylic-acid-5-amino-1-naphthol-3-sulphonic acid. No. 424 (345)	A blackish-brown powder. H_2O: ruby-red solution. Alcohol: reddish-violet solution. HCl to aqueous solution: unaltered. NaOH: unaltered. H_2SO_4: dark violet solution; wine-red solution on dilution. Dyes cotton direct dark brownish-red of good fastness to washing, but of only moderate fastness to light and acids. The fastness is increased by after-treatment with copper salts. Light: 4–3. Used also in calico printing. Discharged moderately white by hydrosulphite on cotton.	Scarcely used.
Direct Red J (StCl) Oxamine Red	A dark brown powder. In water: about $\lambda = 500.0$. H_2O: yellowish-red solution.	

(B) Sodium salt of diphenyl-disazo-salicylic-acid-6-amino-1-naphthol-3-sulphonic acid. No. 425 (346) Made also with β-acid.	Alcohol: slightly soluble with a yellowish-red colour. HCl to aqueous solution: unaltered. NaOH: more violet solution. H_2SO_4: blue solution; wine-red and precipitate on dilution. Dyes cotton direct dark red, moderately fast to acids, alkalies, washing and light. The fastness is increased by after-treatment with copper salts. Light: 4. Used also in calico printing. Discharged moderately white by hydrosulphite on cotton.	
Alkali Yellow R (WDC) Dipheny fast yellow Z(Gy) Sodium salt of diphenyl-azo-salicylic-acid-diazo-amino-sulpho-benzenyl-amino-thiocresol. No. 426 (350)	A brownish-yellow powder. H_2O: yellow opalescent solution. HCl: brownish-yellow precipitate. NaOH: orange-red precipitate. H_2SO_4: brownish-red solution. HNO_3: red. Dyes cotton direct from a faintly alkaline Glauber's salt bath yellow, of good fastness to acids and of moderate fastness to light and washing, but reddened by alkalies. Light: 4–3. Not discharged.	Important product
Direct Grey *R (SCI)* No longer manufactured. Sodium salt of diphenyl-disazo-bis-1:7-dihydroxy-6-naphthoic-3-sulphonic acid. No. 427 (354)	A dark violet-grey powder. H_2O: sparingly soluble cold, violet solution hot. Alcohol: insoluble. HCl to aqueous solution: dark bluish-grey precipitate. NaOH: dull violet-red solution hot, dark reddish-violet precipitate cold. H_2SO_4: blue solution, bluish-grey precipitate on dilution. Dyes cotton direct from a faintly alkaline Glauber's salt bath reddish-grey to bluish-black, fast to light. Light: 3.	No longer manufactured.
Direct Violet R (SCI) **Diphenyl Violet R** (Gy) No. 428 (352) Benzidine-2.8-naphthol 2.8 naphthol sulphonic acid.	A brownish-violet powder. H_2O: violet solution. λ = not distinct. Alcohol: partly soluble, with a bluish-red colour. HCl to aqueous solution: bluish-violet precipitate. NaOH: dull red precipitate. H_2SO_4: deep blue solution; violet solution and then violet precipitate on dilution. Dyes cotton direct reddish-violet. Light: 4. Used also in calico printing. Discharged white by all the usual reagents on cotton.	
Direct Indigo Blue *BN (SCI)* *No.* 429 (353)	A dark blue powder. H_2O: bluish-violet solution. HCl: violet precipitate. NaOH: reddish-violet solution and slight precipitate. H_2SO_4: blue solution;	

Constitution unknown by Schultz in *Colour Index*. Benzidine colour mixture of blue and violet.	violet solution and then violet precipitate on dilution. Dyes cotton direct from an alkaline Glauber's salt bath, and unions from an acetic acid bath, indigo-blue, moderately fast to light, acids and alkalies. A black is obtained by diazotisation on the fibre and development with β- naphthol or *m*-toluylene-diamine. Light: 3.	
Polar Red **G conc. B conc. RS conc.** (Gy) No. 430 G: Benzidine dye B: *o*-tolidine dye R.S. *m*-tolidine dye	*Polar Red G conc.*— A red powder. H_2O: sparingly soluble cold, orange-red solution hot. HCl: dark red solution, brown precipitate with excess. NaOH: red gelatinous precipitate. H_2SO_4: wine-red solution; reddish-violet solution and then brown precipitate on dilution. *Polar Red G conc.* — $\text{Benzidine}\left\langle\begin{array}{l}\text{G-acid}\\ \text{Phenol-}p\text{-toluolsulpho ester}\end{array}\right.$ A brown powder. H_2O: sparingly soluble cold, scarlet solution hot. HCl: bluish-red crystalline precipitate. NaOH: red gelatinous precipitate. H_2SO_4: bluish-violet solution; blue solution and then brown precipitate on dilution. HNO_3: blue. Dyes wool and silk from an acid bath, or from a neutral bath, red, fast to milling and of good fastness to stoving, but possesses little affinity for cotton. Light: 2–3.	
Chrome Red A4B, (NCW) *Anthracene Red* I, (SCI) (By) (SCI) Cochineal substitute Sodium salt of 2-nitro-diphenyl-disazo-salicylic-acid-α-naphthol-4-sulphonic acid. No. 431 (355)	A brownish-red powder. H_2O: readily soluble hot, with a red colour. $\lambda = 502.0$. Alcohol: sparingly soluble. HCl to aqueous solution: flocculent red precipitate. NaOH: unaltered. H_2SO_4: carmine-red solution, brownish-red precipitate on dilution. Dyes wool and silk from an acid bath, or from a neutral bath, level red of moderate fastness, converted by after-chroming into bluish-scarlet of good fastness. Light: 3–2.	
Salicine Red *B, G, GG (K)* Sodium salt of 2-nitro-sulpho-diphenyl-disazo-salicylic-acid-β-naphthol.	A dark red powder. In water: about $\lambda = 503$. H_2O: G, orange solution; B, dark red solution. Alcohol: sparingly soluble; G, orange solution; B, red solution. HCl to	

No. 432	aqueous solution: G, orange-red precipitate; B, dark red precipitate. NaOH: G, reddish-brown solution; B, wine-red solution and faint precipitate. H_2SO_4: G, orange-red solution, reddish-brown precipitate on dilution; B, violet-red solution, dark reddish-brown precipitate on dilution. Dyes wool or chrome-mordanted wool from an acid bath red. Light: 4–3. Level-dyeing 3; relation to cotton 1; relation to silk 4.	
Salicine Yellow *G (K)* Sodium salt of 2-nitro-sulpho-diphenyl-dis-azo-bis-salicylic acid. No. 433	A yellowish-brown powder. H_2O: orange solution. HCl: brownish-yellow precipitate. NaOH: reddish-brown solution. H_2SO_4: orange-yellow solution, brownish-yellow precipitate on dilution. Dyes cotton direct yellow, and chrome-mordanted wool yellow. Light: 3. Level-dyeing 3–4; relation to cotton 4; relation to silk 4.	Scarcely used.
Dianol Red 2B (Lev) **Brilliant Purpurine** 10B (SCI) **Azidine Purpurine** 10B (CJ) Sodium salt of 3:3-dichloro-diphenyl-disazo-bis-α-naphthylamine-4-sulphonic acid. No. 434 (356)	A brownish-red powder. H_2O: red solution. λ = not distinct. Alcohol: red solution. HCl to aqueous solution: violet solution or precipitate. NaOH: red solution. H_2SO_4: blue solution; violet solution and precipitate on dilution. Much less sensitive towards acid than Congo red. Much bluer. Light: 3–2. Dyes cotton direct bluish-red. Used also in calico printing. Discharged white by hydrosulphite on cotton.	
Dianol Red *B (Lev)* Sodium salt of 3:3-dichloro-diphenyl-disazo-bis-β-naphthylamine-6-sulphonic acid. No. 435 (357)	A dark red powder. H_2O: yellowish-red solution. λ = not distinct. Alcohol: yellowish-red solution. HCl to aqueous solution: violet-red solution. NaOH: unaltered. H_2SO_4: blue solution; brown solution on dilution. HNO_3: brown. Dyes cotton direct yellowish-red, fast to organic acids.	Scarcely used.
Dianol Brilliant Red R extra, (Lev) Diphenyl Red 8B (Gy) *Chlorantine Red* 8B, 8BN, (SCI) Azidine Brilliant Red 8B (CJ) Toluylene Red R.T. (GrE) Sodium salt of 3:3-dichloro-diphenyl-disazo-bis-β-naph-	A red powder. H_2O: bluish-red solution. λ = not distinct. Alcohol: insoluble. HCl to aqueous solution: darkened and then a red precipitate. NaOH: yellowish-red solution. H_2SO_4: blue solution; red solution on dilution. HNO_3: violet. Dyes cotton direct bluish-red from a neutral or faintly alkaline salt bath. Light: 3–4. Used also for dyeing wool, silk and unions, and in calico printing.	

thylamine-3:6-disulphonic acid. No. 436 (358)	Discharged white by all the usual reagents on cotton. *Chlorantine Red 8B* (SCI), however, is discharged white by chlorate or stannous chloride, but not by hydrosulphite.	
Glycine Blue (*Ki*) Sodium salt of diphenyl-sulphone-disazo-bis-α-naphthylglycine. No. 437	A dark powder. H_2O: Bordeaux red solution. Alcohol: bluish-red solution. HCl to aqueous solution: violet precipitate. NaOH: red precipitate. H_2SO_4: blue solution, violet precipitate on dilution. Dyes cotton direct blue from an alkaline soap-bath. Light: 3–4.	Not manufactured.
Trypan Red (MLB) Sodium salt of 3-sulpho-diphenyl-disazo-bis-β-naphthylamine-3:6-disulphonic acid. No. 438 (359)	A brown powder. H_2O: red solution. HCl: blue precipitate. Acetic acid: unaltered. Used for medicinal purposes.	
Sulphon Blue 4B (VSt) **Sulphon Azurine** D (By) Sodium salt of 3:3-disulpho-diphenyl-sulphone-disazo-bis-phenyl-β-naphthylamine. No. 439 (361)	A dark greyish-blue powder. In water — $\lambda = 574.5$ and $\lambda = 538.5$. H_2O: blue solution. Alcohol: dark blue solution. HCl to aqueous solution: blue precipitate. NaOH: soluble blue precipitate. H_2SO_4: violet solution, blackish-violet precipitate on dilution. Dyes wool from a neutral bath with addition of Glauber's salt, and cotton direct from a neutral or soap bath blue, of good fastness to acids, alkalies and milling. More suitable for dyeing wool, than for dyeing cotton. Light: 3–2.	
Pyramine Orange **R** (B) Sodium salt of 3:3 disulpho-diphenyl-disazo-bis-nitro-*m*-phenylenediamine. No. 440 (360)	A reddish powder. H_2O: orange-red solution. Alcohol: insoluble. HCl to aqueous solution: yellowish-red precipitate. NaOH: yellowish-red precipitate. H_2SO_4: yellow solution, yellowish-red precipitate on dilution. HNO_3: *id.* Dyes cotton direct bright orange-red of good fastness to washing, acids and alkalies. Light: 3. Used also in calico printing. Discharged moderately white by hydrosulphite on cotton.	A cheap product.
Chromazol Yellow CR (BDC) **Chromocitronine, R** (D.H.) Sodium salt of 2:2-disulpho-diphenyl-	A yellowish-brown powder. H_2O: yellow solution. HCl: brown precipitate with excess. NaOH: orange-brown solution. H_2SO_4: yellowish-brown solution; yellow-solution on dilution. HNO_3: yellow-red.	

disazo-bis-salicylic acid. No. 441	Dyes chrome-mordanted wool or cotton bright yellow of good fastness, particularly to washing **and chlorine.** Discharged white by hydrosulphite on cotton. One of the best yellows for printing calico.	
Chromocitronine RR pdr. (DH) Sodium salt of 2:2-disulpho-diphenyl-disazo-bis-*o*-cresol-carboxylic acid. No. 442	An orange-brown powder. H_2O: yellowish-brown solution. HCl: reddish-brown precipitate. NaOH: orange-red solution. H_2SO_4: reddish-orange solution, reddish-brown precipitate on dilution. Dyes chrome-mordanted wool or cotton bright yellow of good fastness, particularly to washing. Used in calico printing. Discharged white by hydrosulphite on cotton. Same properties as 441, but much duller.	Not much used.
Acid Anthracene Red G, (A) (By) **Acid Milling Red conc.** (Gy) Sodium salt of 2:2-disulpho-diphenyl-disazo-bis-β-naphthol. No. 443	A red powder. H_2O: scarlet solution. Alcohol: orange solution. HCl to aqueous solution: maroon precipitate. NaOH: reddish-brown solution. H_2SO_4: bluish-red solution, maroon precipitate on dilution. Dyes wool from an acid bath red, fast to milling. Light: 2–3.	A cheap product.
Naphthyl Blue 2B(B) Sodiums alt of 3:3-dicarboxy-diphenyl-disazo-bis-8-benzoyl-amino-1-naphthol-4-sulphonic acid. No. 444.	A dark blue powder. H_2O: blue solution. λ = not distinct. Alcohol: very slightly soluble. HCl to aqueous solution: bluish-violet precipitate. NaOH: magenta-red solution. H_2SO_4: pure blue solution, violet precipitate on dilution. Dyes cotton direct pure blue, not fast to light, not very fast to washing, and reddened by alkalies. Light: 2–3.	
Carbazol Yellow (B) Sodium salt of carbazol-disazo-bis-salicylic acid. No. 445	A brownish-yellow powder. H_2O: brownish-yellow solution. HCl: dark brown precipitate. NaOH: orange-yellow solution. H_2SO_4: violet-blue solution, dark brown precipitate on dilution. HNO_3: brown. Dyes cotton direct from a boiling alkaline bath yellow, moderately fast to light and soap, but sensitive to dilute acids and alkalies. Light: 3–4. *Carbazol Yellow* produces shades similar to those of fustic on chrome-mordanted wool, but although fast to washing, they are less fast to light than the latter.	Scarcely used.

Toluylene Orange R (JWL) (S) (GrE) (L) (MLB) **Erie Orange R** (NAC) **Direct Orange R** (Sch) (SCI) (LJ) (StD) **Pluto Orange R** (By) Sodium salt of ditolyl-disazo-bis-*m*-toluylenediamine-sulphonic acid. No. 446 (362)	A brownish-red powder. H_2O: orange-yellow solution. HCl: flocculent bluish-red precipitate. Dilute acetic acid: reddish-opalescent solution. NaOH: unaltered. H_2SO_4: brown solution, reddish precipitate on dilution. HNO_3: red. Dyes cotton direct reddish-orange (D below), converted into a full reddish-brown, fast to washing, by development with diazotised *p*-nitroaniline (N below). Dyes wool from a neutral bath reddish-orange of good fastness to milling. Light: 3–4. The cheapest reddish orange.	
Oxamine Violet GR (*R*) Sodium salt of ditolyl-disazo-*m*-phenylenediamine-oxamic-acid-α-naphthol-4-sulphonic acid. No. 447	A dark bronzy powder. H_2O: bluish-red solution. Alcohol: soluble. HCl to aqueous solution: violet precipitate. NaOH: redder solution and precipitate. H_2SO_4: blue solution, violet precipitate on dilution. Dyes cotton direct dark reddish-violet. Light: 4–3.	
Benzopurpurine 4B **Direct Red 4B** (CCC) (Sch) (StD) (VSt) (StD) BP. **Diazol Purpurine N4B** (CN) **Diamine Red 4B** (MLy) (C) Sodium salt of ditolyl-disazo-bis-α-naphthylamine-4-sulphonic acid. No. 448 (363)	A brown powder. In water: about $\lambda = 501.6$. H_2O: brownish-red solution. HCl: blue precipitate. Dilute acetic acid: brown precipitate. NaOH: unaltered. H_2SO_4: blue solution, blue precipitate on dilution. HNO_3: blue. Dyes cotton direct from an alkaline soap bath, and wool from a neutral bath, scarlet. Light: 4–3. Pink shades dyed with this colouring matter on cotton are moderately fast to washing. Used also in calico printing. Discharges white by all the usual reagents on cotton. Less sensitive to acid than Congo.	Very important colour.
Benzopurpurine 6B (Lev) (A) (By) (GrE) (L) (tM) **Cotton Red 6B** (SCI) **Disazo Brilliant Black B, R.** (By) Sodium salt of di-tolyl-disazo-bis-α-naphthylamine-5-sulphonic acid. No. 449 (364)	A red to brownish-black powder. In water: about $\lambda = 503.0$. H_2O: yellowish-red solution. HCl: blue precipitate. Dilute acetic acid: blue precipitate. NaOH: red solution and precipitate. H_2SO_4: blue solution, blue precipitate on dilution. HNO_3: blue-red. Dyes cotton direct level red from an alkaline soap bath. Light: 4. *Diazo Brilliant Black* (By) dyes cotton direct and is converted into black by diazotisation on the fibre and development with a *m*-diamine, or into blue-	

	black with β-naphthol, whilst a good cutch-brown is obtained by diazotisation on the fibre, followed by treatment with soda. Used also in calico printing. The direct shades are discharged white by hydrosulphite, but the diazotised and developed shades are unsuitable for discharge printing.	
Benzopurpurine B (H) (Lev) (AAP) (A) (By) (GrE) (L) (tM) *Cotton Red B* (SCI) Sodium salt of ditolyl-disazo-bis-β-naphthyl-amine-6-sulphonic acid. No. 450 (365)	A brown powder. In water: about λ = 500.0. H_2O: reddish-brown solution. HCl: brown precipitate. Dilute acetic acid: brown solution. NaOH: unaltered. H_2SO_4: blue solution, dark brown flocculent precipitate on dilution. Dyes: cotton direct level red from an alkaline bath. Light: 4. Used also for dyeing unions and in calico printing. Discharged white by hydrosulphite in presence of leucotrope on cotton.	No longer upon the market.
Diamine Red B (RF) (A) *Deltapurpurine 5B* (Lev) (AAP) (S) (A) (BK) (By) (K) (L) (MLB) *Cotton Red D* (SCI) Sodium salt of ditolyl-disazo-6-sulpho-β-naphthyl amine-β-naphthyl amine-7-sulphonic acid. No. 451 (366)	A reddish-brown powder. H_2O: bright yellowish-red solution. HCl: brown precipitate. Dilute acetic acid: brown solution. Glacial acetic acid: brown precipitate. $MgSO_4$ solution: brown precipitate of the magnesium salt. NaOH: red precipitate, H_2SO_4: blue solution, brown precipitate on dilution. Dyes cotton direct red from an alkaline soap bath. Light: 4. Used also for dyeing almost uniform shades on unions of cotton, wool and silk: also in calico printing. Discharged white by hydrosulphite in presence of leucotrope on cotton.	Not used to any large extent.
Deltapurpurine 7B (Lev) (A) (By) Diamine Red 3B (RF) (A) (C) Sodium salt of ditolyl-disazo-bis-β-naphthylamine-7-sulphonic acid. No. 452. (367)	A reddish-brown powder. In water: about λ = 501.5. H_2O: scarlet-red solution hot. HCl: brown precipitate. Acetic acid: brownish-violet precipitate. NaOH: red precipitate. $MgSO_4$ solution: precipitate of the magnesium salt. H_2SO_4: blue solution, yellowish-brown precipitate on dilution. Dyes cotton direct red from an alkaline bath. Light: 3–4.	
Brilliant Purpurine 4B, (*RF*) (*A*) (*By*) Sodium salt of ditolyl-disazo-4-sulpho-α-naphthyl-amine-β-naphthyl-amine-6-	A reddish-brown powder. H_2O: yellowish-red solution. HCl: violet-blue solution. NaOH: rather yellower solution. H_2SO_4: violet-blue solution, violet-blue precipitate on dilution. HNO_3: blue.	

sulphonic acid. No. 453 (368)	Dyes cotton direct level yellowish-red. Light: 4–3.	
Brilliant Purpurine R, (*RF*) (*A*) (*By*) (*L*) Sodium salt of ditolyl-disazo-3:6-disulpho-β-naphthylamine-α-naphthylamine-4-sulphonic acid. No. 454 (369)	A red powder. H_2O: red solution. λ = not distinct, about 503 Alcohol: yellowish-red solution. HCl to aqueous solution: black precipitate. NaOH: soluble red precipitate. H_2SO_4: blue solution, blue-black precipitate on dilution. HNO_3: blue. Dyes cotton direct level bright red from an alkaline bath. Light: 4–3. Used also for dyeing unions and in calico printing. Discharged white by hydrosulphite on cotton.	
Brilliant Congo 2R (A) Sodium salt of ditolyl-disazo-3:6-disulpho-β-naphthylamine-β-naphthylamine-7-sulphonic acid. No. 455	A brown powder. H_2O: brownish-red solution. λ = about 498.0 HCl: reddish-brown precipitate. NaOH: soluble reddish-yellow precipitate. H_2SO_4: blue solution, brownish-black precipitate on dilution. HNO_3: black. Dyes cotton direct red from a soap bath. Light: 3–4.	
Acid Congo R (SCI) Brilliant Congo R (A) (By) (L) Brilliant Dianil Red R, (MLB) Sodium salt of ditolyl-disazo-3:6-disulpho-β-naphthylamine-β-naphthylamine-6- sulphonic acid. No. 456 (370)	A brown powder. H_2O: brownish-red solution. λ: about 496.0 HCl: reddish-brown precipitate. Dilute acetic acid: rather bluer solution. NaOH: soluble reddish-yellow precipitate. H_2SO_4: blue solution; olive solution, and then brownish-black precipitate on dilution. Dyes cotton direct red from a soap bath. Light: 3–4. Used also for dyeing unions. Satisfactory white discharges cannot be obtained with any of the usual reagents.	
Rosazurine G (A) (By) Sodium salt of ditolyl-7-sulpho-ethyl-β-naphthylamine-β-naphthylamine-7-sulphonic acid. No. 457 (371)	A reddish-brown powder. H_2O: cherry-red solution. λ = about 520, not distinct. HCl: reddish-violet precipitate. Dilute acetic acid: unaltered. NaOH: scarcely altered. H_2SO_4: blue solution, reddish-violet precipitate on dilution. HNO_3: red-blue. Dyes cotton direct level bluish-red from an alkaline bath. Light: 3.	
Rosazurine B (*A*) (*By*) Sodium salt of ditolyl-disazo-bis-ethyl-β-naphthylamine-7-sulphonic acid. No. 458 (372)	A brown powder. H_2O: cherry-red solution. λ = 530.8 and 581.0 HCl: reddish-violet precipitate. Dilute acetic acid: colour rather darker. NaOH: soluble bluish-red precipitate.	

	H_2SO_4: blue solution, violet precipitate on dilution. HNO_3: blue. Dyes cotton direct level bluish-red from an alkaline bath. Light: 3.	
Congo Orange R (RF) (A) (By) (L) Sodium salt of ditolyl-disazo-3:6-disulpho-β-naphthylamine-phenetole. No. 459 (373) Polar orange R (Gy) similar, but instead of $-OC_2H_5$ $O - SO_2 - C_7H_7$: No affinity for cotton. G.S. with *m*-Tolidine.	A yellowish-red powder. H_2O: yellowish-red solution. Alcohol: slightly soluble. HCl to aqueous solution: dark brown precipitate. NaOH: unaltered. H_2SO_4: dark blue solution, dark brown precipitate on dilution. HNO_3: blue. Dyes cotton direct level orange. Used largely also for dyeing wool, silk and unions orange, fast to light on wool and silk; also in calico printing. Light: 2–3. Discharged white by all the usual reagents on cotton.	
Congo Red 4R, (JBS) (LDC) RF) (By) Congo 4R (A) Sodium salt of ditolyl-disazo-4-sulpho-α-naphthylamine-resorcinol. No. 460 (374)	A brown powder. H_2O: brownish-red solution. HCl: violet precipitate. Dilute acetic acid: brown precipitate. NaOH: scarcely altered. H_2SO_4: blue solution, violet precipitate on dilution. Dyes cotton direct level red, from a soap bath. Light: 4–3. A mixture, optically.	
Congo Corinth B (J B S) (L D C) (L e v) (S) (A) (BK) (By) (L) **Cotton Corinth B** (GrE) Dianil Bordeaux B (MLB) Sodium salt of ditolyl-disazo-4-sulpho-α-naphthylamine-α-naphthol-4-sulphonic acid. No. 461 (375)	A greenish-black powder. H_2O: magenta-red solution. $\lambda = 528.5$ and [568.] and [495.0]. HCl: violet precipitate. Dilute acetic acid: rather bluer solution. NaOH: cherry-red solution. H_2SO_4: blue solution, violet precipitate on dilution. HNO_3: blue. Dyes cotton direct brownish-violet from an alkaline soap bath. Light: 3–4. Satisfactory white discharges cannot be obtained with any of the usual reagents.	
Pyramidol Brown T (LDC) (FA) Sodium salt of ditolyl-disazo-bis-resorcinol. No. 462 (376)	A dark brown powder. H_2O: reddish-brown solution. Alcohol: orange solution. HCl to aqueous solution: brown precipitate. NaOH: brownish-red solution. H_2SO_4: violet solution, blackish-brown precipitate on dilution. HNO_3: violet-brown. Dyes cotton direct brownish-red, converted into deep brown, fast to washing, by development with diazo-compounds. Light: (*p*-nitroaniline product) 3.	
o Blue DC) (Lev) (A) (By) (OeV) **rect Violet B**	A bluish-black powder with a metallic lustre. In water: $\lambda = 560.3$. H_2O: violet solution.	

(ICA) Sodium salt of ditolyl-disazo-bis-α-naphthol-4-sulphonic acid. No. 463 (377)	HCl: violet precipitate. Dilute acetic acid: unaltered. NaOH: magenta-red solution and dark red precipitate. H_2SO_4: blue solution, violet precipitate on dilution. HNO_3: blue. Dyes cotton direct reddish-violet, moderately fast to washing and dilute acids, but reddened by alkalies, rendered greener and faster to light by after-treatment with copper sulphate. Light: 3–4. Used also in calico printing. Discharged white by hydrosulphite or stannous chloride on cotton.	
Trisulphon Blue R. (JBS) (S) *Direct Blue 3R* (NCW) Sodium salt of ditolyl-disazo-3:6:8-trisulpho-α-naphthol-β-naphthol. No. 464 (378)	A dark bronzy powder. In water: about λ = 565.0. H_2O: blue solution. Alcohol: sparingly soluble. HCl to aqueous solution: blue precipitate. NaOH: reddish-violet solution. H_2SO_4: greenish-blue solution, blue precipitate on dilution. Dyes cotton direct reddish-blue, moderately fast to washing, dilute acids and alkalies. The fastness to washing is increased by after-treatment with dichromate. Light: 2. Dyes wool: and silk: from a neutral or acetic acid bath a redder shade of blue than that produced on cotton. Used also in calico printing. Discharged white by hydrosulphite or stannous chloride on cotton.	
Benzo New Blue 2B (By) Dianil Blue 2R (MLB) Sodium salt of ditolyl-disazo-3:6-disulpho-1:8-dihydroxy-naphthalene-α-naphthol-4-sulphonic acid. No. 465 (379)	A blue powder. In water: about λ = 572.0. H_2O: blue solution. Alcohol: insoluble. HCl to aqueous solution: scarcely altered. NaOH: scarcely altered. H_2SO_4: blue solution; bluish-violet solution on dilution. Dyes cotton direct blue. Light: 3–4. Used also in calico printing. Discharged white by hydrosulphite on cotton.	
Benzo New Blue 5B (By) Dianil Blue B (MLB) Sodium salt of ditolyl-disazo-bis-1:8-dihydroxy-naphthalene-3:6-disulphonic acid. No. 466 (380)	A blue powder. In water: λ = 580.0. H_2O: blue solution. Alcohol: almost insoluble. HCl to aqueous solution: unaltered. NaOH: unaltered. H_2SO_4: deep blue solution; bluish-violet solution on dilution. Dyes cotton direct blue from a salt bath. Light: 3. Used also in calico printing. Discharged white by hydrosulphite on cotton.	
Azo Black Blue B, R,	A greyish-brown powder.	

(GrE) Azo Navy Blue (GrE) Sodium salt of ditolyl-disazo-*m*-hydroxy-diphenylamine-8-amino-1-naphthol-3:6-disulphonic acid. No. 467 (381)	H_2O: brownish-violet solution. λ = no distinct absorption. HCl: brownish-violet precipitate. H_2SO_4: blue solution, bluish-violet precipitate on dilution. HNO_3: violet. Dyes cotton direct from an alkaline salt bath grey to violet-blue, of good fastness to alkalies and washing, moderate fastness to light, and very low fastness to chlorine. The fastness to washing, alkalies and acids is improved by after-chroming. Light: 3–4.	
Azo Mauve B (*GrE*) Sodium salt of ditolyl-disazo-α-naphthylamine-8-amino-1-naphthol-3:6-disulphonic acid. No. 468 (382)	A blackish powder with a bronzy lustre. H_2O: reddish-violet solution. λ = 574.5. Alcohol: insoluble. HCl to aqueous solution: violet precipitate. Dilute acetic acid: rather bluer solution. NaOH: soluble violet precipitate. H_2SO_4: blue solution; bluish-violet solution and precipitate on dilution. HNO_3: brown-red. Dyes cotton direct from an alkaline salt bath blackish-blue-violet, moderately fast to soap, dilute acids and alkalies. Light: 3–4. A black fast to washing and alkalies is obtained by diazotisation upon the fibre and development with *m*-toluylene-diamine.	
Naphthazurine B (GrE) Sodium salt of ditolyl-disazo-β-naphthyl-amine-8-amino-1-naphthol-3:6-disulphonic acid. No. 469 (383) Mixtures, according to Formánek.	A grey powder. H_2O: bluish-violet solution. Alcohol: insoluble. HCl to aqueous solution: violet-blue precipitate. NaOH: scarcely altered. H_2SO_4: blue solution, bluish-violet precipitate on dilution. HNO_3: blue. Dyes cotton direct blue, of good fastness to acids and alkalies and moderately fast to light. Light: 3–4.	
Chicago Blue 2R (A) *Benzo Blue 2R* (By) Diamine Blue C2R (C) Sodium salt of di-tolyl-disazo-8-sul-pho-β-naphthol-8-amino-1-naphthol-5-sulphonic acid. No. 470 (384)	A dark powder with a bronzy lustre. H_2O: violet-blue solution. λ: (points to mixtures) about 567.0. Alcohol: reddish-violet solution. HCl to aqueous solution: dark blue precipitate. NaOH: reddish-violet solution. H_2SO_4: blue solution, blue precipitate on dilution. Dyes cotton direct level reddish-blue, and wool level blue from a boiling neutral bath. Light: 3–4. Used also in machine dyeing; also in calico printing. Discharged white by hydrosulphite on cotton.	

Benzoazurine 3R (By) (GrE) *Naphthamine Blue 2RE, 3RE,* (K) *Dianil Azurine 3R* (MLB) Sodium salt of ditolyl-disazo-3-sulpho-6-amino-1-naphthol-α-naphthol-4-sulphonic acid. No. 471 (385)	A brownish-violet powder. H_2O: violet solution. $\lambda = 542.5$. Alcohol: slightly soluble, with a violet colour. HCl to aqueous solution: violet precipitate, soluble in water. NaOH: violet solution or precipitate. H_2SO_4: pure blue solution, violet precipitate on dilution. Dyes cotton direct from a Glauber's salt bath violet-blue, moderately fast to washing, and of good fastness to acids and alkalies, converted into bluish-violet by diazotisation on the fibre and development with β-naphthol. Light: 3–4. Not discharged satisfactorily by any of the usual reagents.	
Benzo Blue BX (LDC) **Direct Blue BX** BXX, (AAP) (NCW) (SCI) (StD) (ICA) (StD) **Diamine Blue BX** (MLy) (C) **Naphthamine Blue BX,** (K) (OeV) Sodium salt of ditolyl-disazo-3:6-disulpho-8-amino-1-naphthol-α-naphthol-4-sulphonic acid. No. 472 (386)	A dark reddish-blue to black powder. In water: $\lambda = 563.5$. H_2O: bluish-violet solution. Alcohol: slightly soluble. HCl to aqueous solution: violet precipitate. NaOH: bluish-red solution. H_2SO_4: blue solution, violet precipitate on dilution. Dyes cotton direct blue from a neutral or alkaline bath; it can be diazotised on the fibre and developed. Light: 3–4. Used also for dyeing unions and half-silk; also in calico printing. The direct shade is discharged white by hydrosulphite on cotton.	
Columbia Blue G (A) *Benzo Red-Blue G* (By) *Diamine Blue LG* (C) *Naphthamine Blue CBG* (K) Sodium salt of ditolyl-disazo-3:8-disulpho-α-naphthol-8-amino-1-naphthol-5-sulphonic acid. No. 473 (387)	A blue powder. In water $\lambda = 575.7$. H_2O: pure blue solution. Alcohol: insoluble. HCl to aqueous solution: soluble blue precipitate. NaOH: reddish-violet precipitate. H_2SO_4: greenish-blue solution, reddish-violet precipitate on dilution. HNO_3: *id.* Dyes cotton direct level blue. Light: 3–4. Used also for dyeing unions from a cold bath; also in calico printing. Discharged white by hydrosulphite on cotton.	
Chicago Blue R (A) (By) *Benzo Blue R* (By) *Diamine Blue CR* (C) Sodium salt of ditolyl-disazo-bis-8-amino-1-naphthol-5-sulphonic acid. No. 474 (388)	A blue powder. H_2O: violet-blue solution. λ: points to mixtures. Alcohol: blue solution. HCl to aqueous solution: dark violet precipitate. NaOH: unaltered. H_2SO_4: blue solution, bluish-violet precipitate on dilution. HNO_3: *id.* Dyes cotton direct level blue. Light: 3–4.	

	Used also in calico printing. Discharged white by hydrosulphite on cotton.	
Eboli Blue B (L) Sodium salt of ditolyl-disazo-bis-8-amino-1-naphthol-4:6-disulphonic acid. No. 475 (389)	A greyish-blue powder. H_2O: blue solution. $\lambda = 588.5$ and [630.5]. HCl: soluble blue precipitate. NaOH: reddish-violet solution. H_2SO_4: blue solution, unaltered on dilution. Dyes cotton direct blue, which is fast to washing, when after-chromed. Light: 3–4. Used also for dyeing wool and unions.	Not manufactured.
Congo Cyanine B (A) Benzo Cyanine B (By) Diamine Cyanine B (C) Sodium salt of ditolyl-disazo-3:6-disulpho-8-amino-1-naphthol-8-amino-1-naphthol-5-sulphonic acid. No. 476 (390)	A bluish-grey powder. H_2O: blue solution. $\lambda = 579.5$. HCl: soluble blue precipitate. NaOH: soluble reddish-blue precipitate. H_2SO_4: greenish-blue solution; reddish-blue solution on dilution. HNO_3: *id.* Dyes cotton direct from a neutral or faintly alkaline Glauber's salt bath pure blue, fast to acids, but not fast to light or alkalies. The fastness is improved by after-treatment with copper sulphate. Light: 3–4:. Used also in calico printing. The direct shade is discharged white by hydrosulphite on cotton.	
Trypan Blue (BDC) (MLB) N (CN) Direct Blue 3B, (JWL) (AAP) (CCC) (NCW) (SCI) (MC) (StCl) (StD) (ICA) **Benzo Blue 3B** (LDC) (By) **Congo Blue 3B** (Lev) (A) **Chloramine Blue 3B** (S) **Diamine Blue 3B** (MLy) (C) **Naphthamine Blue 3BX** (K) (OeV) Sodium salt of ditolyl-disazo-bis-8-amino-1-naphthol-3:6-disulphonic acid. No. 477 (391)	A bluish-grey powder. H_2O: violet solution. $\lambda = 617.5$; 584.5 Alcohol: insoluble. HCl to aqueous solution: violet precipitate with excess. NaOH: violet solution and blue precipitate. H_2SO_4: greenish-blue solution, blue solution and then violet precipitate on dilution. HNO_3: *id.* Dyes cotton direct blue. Light: 3–4. Used also in calico printing. Discharged white by hydrosulphite on cotton. Trypan Blue is used for therapeutic purposes in diseases such as sleeping sickness.	
Erie Orange Y (NAC) Direct Orange Y G, J, (Sch) (S) (SCI) (LJ) (StD)	A yellowish-red or yellowish-brown powder. In water partial absorption in blue and violet. H_2O: brownish-yellow solution. HCl: yellowish-brown flocculent precipitate. Dilute acetic acid: unaltered.	

(SCI) **Toluylene Orange G** (S) (A) (By) (GrE) (L) Pluto Orange G (By) Dianil Orange N (MLB) Renol Orange G (tM) Sodium salt of di-tolyl-disazo-*o*-cresol-carboxylic-acid-*m*-toluylene-diamine-sulphonic acid. No. 478 (392)	NaOH: reddish-orange colour and precipitate. H_2SO_4: magenta-solution, brownish precipitate on dilution. HNO_3: brown. Dyes cotton direct from a soap and sodium phosphate bath orange to yellow, converted by development with diazotised *p*-nitroaniline into red-brown (N below); the direct shade is not fast to storing. Wool is dyed from a neutral or, faintly acid bath bright orange, fast to milling. Light: 3–4. Used also in calico printing. The direct shade is discharged white by hydrosulphite on cotton in the case of *Toluylene Orange G* and *Pluto Orange G*, for example, but not in the case of *Pyramine Orange 2G* and *Oxydiamine Orange G*. **Most important of all Direct Orange dyes.**	
Diphenyl Brown 3GN (Gy) Sodium salt of ditolyl-disazo-salicylic-acid-7-dimethyl-amino-1-naphthol-3-sulphonic acid. No. 479 (393)	A dark brown powder. H_2O: dark yellowish-brown solution. Alcohol: brown solution hot. HCl to aqueous solution: brownish-red precipitate. NaOH: brown solution. H_2SO_4: violet-blue solution, brownish-red precipitate on dilution. HNO_3: *id.* Dyes cotton direct dark yellowish-brown. Light: 3. The yellowest of all Direct Browns.	
Chrysamine R (JBS) (LDC) (Lev) (AAP) (S) (A) (By) (L) (OeV) (tM) Direct Yellow GR (ICA) Sodium salt of ditolyl-disazo-bis-salicylic acid. No. 480 (394)	A yellowish-brown powder. In water: partial absorption in blue and violet. H_2O: brownish-yellow solution. HCl: brown flocculent precipitate. Dilute acetic acid: brown flocculent precipitate. NaOH: soluble orange-red precipitate. H_2SO_4: reddish-violet solution, brown flocculent precipitate on dilution. HNO_3: *id.* Dyes cotton direct level yellow from a soap bath and wool from a boiling neutral bath. Light: 3–2. The fastness to light is increased by after-treatment with copper sulphate, which also saddens the shade. The direct shade is rendered fast to washing by after-treatment with dichromate or chromium fluoride. Used also in calico printing. Discharged white by hydrosulphite on cotton.	
Cresotine Yellow R (JBS) (A) (By) (GrE) Azidine Yellow R (CJ)	A light brown powder. H_2O: yellow solution. HCl: brownish-yellow flocculent precipitate. Dilute acetic acid: yellow precipitate. NaOH: soluble orange-	

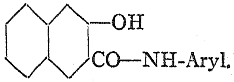
Sodium salt of ditolyl-disazo-bis-*o*-cresol-carboxylic acid. No. 481 (395)	red precipitate. H_2SO_4: violet solution; blue, green and finally yellow precipitate on dilution. HNO_3: *id.* Dyes cotton direct yellow, fast to light and moderately fast to washing. Light: 3–2. Replaced largely by Sun-Yellow and Chrysophenine, G.O.O.	
Indazurine RM (*SCI*) Sodium salt of ditolyl-disazo-5-sulpho-7-carboxy-2:8-dihydroxy-naphthalene-α-naphthol-4-sulphonic acid. No. 482 (396)	A blackish-green powder. H_2O: violet-blue solution. λ: points to mixtures. Alcohol: sparingly soluble with a wine-red colour. HCl to aqueous solution: bluer solution. NaOH: red solution. H_2SO_4: blue solution, violet precipitate on dilution. HNO_3: *id.* Dyes cotton direct reddish-blue. Light: 3–4.	
Zambesi Blue R, RX (*Lev*) (*A*) Sodium salt of ditolyl-disazo-3-sulpho-7-amino-1-naphthol-2-hydroxy-3-naphthoic acid. No. 483.	A grey powder. H_2O: violet solution. HCl: blue precipitate. NaOH: redder solution and soluble precipitate. SH_2O_4: blue solution, blue precipitate on dilution. Dyes cotton direct from a faintly alkaline salt bath, and yields, when diazotised on the fibre and developed, navy to indigo-blue with β-naphthol- or naphthylamine and black with *m*-toluylenediamine; these developed shades are fast to washing, alkalies and acids, and moderately fast to light. Light: 4–3. Used also in calico printing. The diazotised and developed shade is discharged white by hydrosulphite on cotton.	No longer manufactured.
Direct Blue R (SCI) Sodium salt of ditolyl-disazo-3-sulpho-6-carboxy-1:7-dihydroxy-naphthalene-α-naphthol-4-sulphonic acid. No. 484 (397)	A bluish-black powder. H_2O: violet solution. λ = not distinct. Alcohol: insoluble. HCl to aqueous solution: violet precipitate. NaOH: violet-red solution. H_2SO_4: blue solution, violet precipitate on dilution. HNO_3: *id.* Dyes cotton direct blackish-violet of good fastness to acids and alkalies, of moderately good fastness to washing and reddened by ironing, converted into deep black by after-treatment with dichromate or copper sulphate. Light: 3. Used for dyeing compound shades.	
Indazurine TS (SCI) Sodium salt of ditolyl-disazo-5-sulpho-7-carboxy-2:8-dihy-	A blackish-blue powder. In water: λ = 570.0. H_2O: violet-blue solution. Alcohol: sparingly soluble, with a reddish-violet colour.	

droxy-naphthalene-7-amino-1-naphthol-3.sulphonic acid. No. 485 (399)	HCl to aqueous solution: redder solution. NaOH: redder solution. H_2SO_4: blue solution, violet precipitate on dilution. HNO_3: *id.* Dyes cotton direct reddish-blue which, when diazotised, on the fibre and developed with β-naphthol, is converted into blackish-blue. Light: 3–4.	
Direct Grey B (SCI) Sodium salt of ditolyl-disazo-bis-1:7-dihydroxynaphthalene-6-carboxy-3-sulphonic acid. No. 486 (398)	A greyish-black powder. H_2O: blue solution. Alcohol: insoluble. HCl to aqueous solution: dark blue precipitate. NaOH: dark violet precipitate. H_2SO_4: bluish solution, greyish-blue precipitate on dilution. HNO_3: *id.* Dyes cotton direct from a faintly alkaline Glauber's salt bath grey of good fastness to washing, acids, alkalies and ironing and of moderately good fastness to light. Light: 3.	
Acid Anthracene Red DPC 3B, (DPC) (By) **Fast Acid Red B** (K) **Acid Milling Red R conc.** (Gy) Sodium salt of disulpho-ditolyl-disazo-bis-β-naphthol. No. 487 (400)	A carmine-red powder. H_2O: turbid crimson-red solution. λ: ca. 533.0 and 497.5 Alcohol: bright red solution. HCl to aqueous solution: violet precipitate. NaOH: clear currant-red solution. H_2SO_4: violet-red solution, dirty violet precipitate on dilution. HNO_3: red. Dyes wool and chrome-mordanted wool from an acid bath, or wool and silk from a neutral bath, bright red. Level-dyeing 5; relation to cotton 2; relation to silk 4. Light: 3. Used also for printing slubbing. Discharged white by hydrosulphite on wool.	
Diamine Yellow N pdr. and paste (*MLy*) (*C*) Sodium salt of ethoxy-diphenyl-disazo-salicylic-acid-phenetole. No. 488 (404)	A brownish-yellow powder or paste. In alcohol: partial absorption in blue and violet. H_2O: sparingly soluble. Alcohol: more readily soluble than in water. HCl to aqueous solution: greenish precipitate. NaOH: soluble reddish-yellow precipitate. H_2SO_4: violet solution, greenish-brown precipitate on dilution. HNO_3: *id.* Dyes cotton direct yellow, fast to light and moderately fast to washing, but rendered faster to washing by after-treatment with chromium fluoride. Light: 3–2. Used also in calico printing. Discharged white by hydrosulphite on cotton.	
Diamine Red NO (MLy) (C) Sodium salt of ethoxy-diphenyl-disazo-6-	A greenish crystalline powder. H_2O: red solution. Alcohol: sparingly soluble with a red colour. HCl to aqueous solution:	

sulpho-β-naphthyl-amine-β-naphthyl-amine-7-sulphonic acid. No. 489	violet precipitate. NaOH: unaltered. H_2SO_4: blue solution, black precipitate on dilution. HNO_3: *id.* Dyes cotton direct red from an alkaline salt bath.	Scarcely used.
Diamine Blue 3R (MLy) (C) Sodium salt of ethoxy-diphenyl-disazo-bis-α-naphthol-4-sulphonic acid. No. 490 (401)	A black powder with a bronzy lustre and greenish reflex. H_2O: reddish-blue solution. λ: about 590. Alcohol: sparingly soluble. HCl to aqueous solution: reddish-violet precipitate. NaOH: reddish-violet solution. H_2SO_4: dark blue solution, violet precipitate on dilution. HNO_3: *id.* Dyes cotton direct reddish-blue, moderately fast to light and washing, unaffected by dilute acids, but reddened by alkalies. After-treatment with copper sulphate produces a violet, very fast to light and of increased fastness to washing. Used also in calico printing. Discharged white by hydrosulphite on cotton.	No longer used.
Diamine Blue B (C) Sodium salt of ethoxy-diphenyl-disazo-3:7-disulpho-β-naphthol-α-naphthol-4-sulphonic acid. No. 491.	A dark powder with a bronzy lustre. H_2O: blue solution. λ: no available record. Alcohol: insoluble. HCl to aqueous solution: blue precipitate. NaOH: reddish-blue solution. H_2SO_4: blue solution, blue precipitate on dilution. HNO_3: blue. Dyes cotton direct blue. Light: 4. Used also in calico printing. Discharged white by hydrosulphite on cotton.	No longer manufactured.
Diamine Blue-Black E (MLy) (C) Sodium salt of ethoxy-diphenyl-disazo-3:7-disulpho-β-naphthol-7-amino-1-naphthol-3-sulphonic acid. No. 492 (402)	A black powder. H_2O: blackish-blue solution. Alcohol: insoluble. HCl to aqueous solution: blue precipitate. NaOH: unaltered. H_2SO_4: blackish-blue solution, blue precipitate on dilution. Dyes cotton direct blackish-blue, moderately fast to light and washing, rendered brighter and fast to washing by diazotisation on the fibre and development with β-naphthol or Fast Blue Developer AD (C) (amino-diphenylamine). Light: 3–4. Used also in calico printing. Discharged white by hydrosulphite on cotton.	No longer manufactured.

Diamine Black BO (MLy) (C) Sodium salt of ethoxy-diphenyl-disazo-bis-7-amino-1-naphthol-3-sulphonic acid. No. 493 (403)	A black powder. H_2O: blackish-blue solution. Alcohol: sparingly soluble. HCl to aqueous solution: blue precipitate. NaOH: unaltered. H_2SO_4: blackish-blue solution, reddish-blue precipitate on dilution. HNO_3: *id.* Dyes cotton direct blue-black, which diazotised on the fibre and developed with a *m*-diamine is converted into deep black of excellent fastness, or with β-naphthol is converted into deep blue-black. Light: 3.	Not manufactured.
Oxamine Black BR (*R*) Sodium salt of dimethoxy diphenyl-disazo-*m*-phenylene-diamine-oxamic-acid-α-naphthol-4-sulphonic acid. No. 494	A dark bronzy powder. H_2O: readily soluble. Alcohol: soluble. HCl to aqueous solution: blackish-blue precipitate. NaOH: magenta-red solution. H_2SO_4: greenish-blue solution, bluish-black precipitate on dilution. HNO_3: *id.* Dyes cotton direct black, converted into deep blue-black by diazotisation and development upon the fibre. Light: 3–4.	
Benzopurpurine 10B 10B conc., (BDC) (JBS) (LDC) (Lev) (AAP) (S) (StCl) (A) (By) (GrE) (K) (L) (OeV) (tM) (NCW) **Cotton Red 10B** (SCI) (StD) **Diamine Red 10B** (C) **Dianil Red 10B** (MLB) Sodium salt of dimethoxydiphenyl-disazo-bis-α-naphthylamine-4-sulphonic acid. No. 495 (405)	A brownish-red powder. In water: about $\lambda = 518.6$. H_2O: scarlet-red solution. Alcohol: red solution. HCl to aqueous solution: blue precipitate. NaOH: soluble red precipitate. H_2SO_4: blue solution, blue precipitate on dilution. Dyes cotton direct carmine-red from an alkaline bath, and wool from a neutral or faintly acid (acetic acid) bath. The bluest Congo-red. Some of the brands of this colouring matter, for example *Diamine Red 10B* (C), are faster to acids than others. The sensitiveness of the dyed shade to acids may be decreased by after-treatment with Solidogen (MLB), *cf.* No. 370. Light: 3–4. Used also for dyeing unions; also in calico printing. Discharged white by hydrosulphite on cotton.	
Diazurine B (By) Sodium salt of dimethoxy-diphenyl disazo-bis-α-naphthylamine-6-sulphonic acid. No. 496 (406)	A dark blue powder. H_2O: brownish-red solution. Alcohol: insoluble. HCl to aqueous solution: blue precipitate. NaOH: soluble red precipitate. H_2SO_4: blue solution, blue precipitate on dilution. HNO_3: *id.* Dyes cotton direct dull shades, sensitive to light, converted by diazotisation on the fibre and development with β-naphthol into indigo-blue, moderately	

	fast to washing, unaffected by acid or alkalies, but not fast to light. Light: 4. Of no value undeveloped.	
Heliotrope B (A) (By) (L) Sodium salt of dimethoxy-diphenyl-disazo-bis-ethyl-β-naphthylamine-7-sulphonic acid. No. 497	A brown powder. H_2O: magenta-red solution. HCl: violet precipitate. Dilute acetic acid: reddish-violet solution. NaOH: scarcely altered, or a soluble crimson-red precipitate. H_2SO_4: blue solution, bluish-violet precipitate on dilution. HNO_3: *id.* Dyes cotton direct reddish-violet from an alkaline salt bath. The fastness to light and washing is increased by after-treatment with copper sulphate. Light: 3. Used also for dyeing half-silk; also in calico printing. Discharged white by hydrosulphite on cotton.	
Azo Violet (LDC) (Lev) (A) (By) (L) Sodium salt of dimethoxy-diphenyl-disazo-4-sulpho-α-naphthylamine-α-naphthol-4-sulphonic acid. No. 498 (407)	A blackish-blue powder. In water: λ = 551.5. H_2O: reddish-violet solution. Alcohol: insoluble. HCl to aqueous solution: blue precipitate. Dilute acetic acid: bluish-violet solution. NaOH: magenta-red solution. H_2SO_4: blue solution, blue precipitate on dilution. HNO_3: *id.* Dyes cotton direct from a soap bath bluish-violet, moderately fast to light, acids, alkalies and washing. The shade is rendered bluer and faster to light and washing by after-treatment with copper sulphate. Used also in calico printing. Discharged white by hydrosulphite on cotton. Light: 3–4.	
On the Fibre— **Dianisidine Blue** (MLB) Stabilised Tetrazotised Dianisidine Azophor Blue D (MLB) The Amine or its Salts— Dianisidine Base (BDC) (GrE) (MLB) Fast Blue B Base (GrE) Fast Blue B Salt	*Reactions on the Fibre—* Boiling Water: scarcely affected. Boiling Benzene: reddish-violet extract. Boiling Alcohol: faint reddish extract. Boiling NaOH: reddish-violet extract and the fibre is reddish-violet. H_2SO_4: bluish-grey fibre, and the colour is extracted slowly. HNO_3: blue-grey. In H_2SO_4 λ = 663.2 and 614.2. Dyes cotton padded with β-naphthol and a fatty acid, and developed with a solution of tetrazotised dianisidine containing a copper salt, a rather reddish-blue. It cannot be produced well on yarn and is too sensitive to acids to be largely used on piece goods. The violet lake produced without copper is not sensitive to acids. Light: 2–1.	

(GrE) Components— β-Naphthol + fatty acid. Dianisidine β-Naphthol + copper salt. No. 499 (408)	**New: Naphthol A, S, A, N, etc. all of the type:**  Light: 1.
The Mixed Amines— Azo Black O Base (MLB) Stabilised Tetrazotised Amines— Azophor Black S (MLB) Components— β-Naphthol + fatty acid. Dianisidine Benzidine *m*-Nitroaniline β-Naphthol + copper salt. No. 500	Dyes cotton padded with β-naphthol and a fatty acid and developed with a solution of a mixture of tetrazotised dianisidine and benzidine, and diazotised *m*-nitroaniline, containing copper sulphate, a rather reddish black. Used mainly in calico printing.
Trisulphone Blue B (JBS) (S) Silk Blue R (NCW) Sodium salt of dimethoxy-diphenyl-disazo-3:6:8-trisulpho-α-naphthol-β-naphthol. No. 501 (409)	A bluish-grey powder. In water: λ = 577.0 and 638.5. H_2O: blue solution. Alcohol: sparingly soluble. HCl to aqueous solution: blue precipitate. NaOH: reddish-violet solution. H_2SO_4: greenish-blue solution, blue precipitate on dilution. HNO_3: blue. Dyes cotton direct greenish-blue of low fastness to light. The fastness to washing is increased by after-chroming. Light: 4–3. Used also for dyeing unions.
Benzoazurine G G extra, R (L D C) (L e v) (S) (SCI) (LJ) (MC) (A) (By) (GrE) (K) (L) (OeV) (NCW) (A) (By) (GrE) (L) Direct Blue G extra (Sch) B (StD) Oxydiamine Blue G (MLy) (C) Bengal Blue G (GrE) Renol Blue B (tM) Sodium salt of dimethoxy-diphenyl-disazo-bis-α-naphthol-4-sulphonic acid. No. 502 (410)	A bluish-black powder with a bronzy lustre. H_2O: bluish-violet solution. λ = 569.0. HCl: violet precipitate. Dilute acetic acid: unaltered. NaOH: magenta-red solution. H_2SO_4: blue solution, bluish-violet precipitate on dilution. HNO_3: *id.* Dyes cotton direct reddish indigo-blue (too red for green shades) from an alkaline bath. The dyed shade is converted into red by heating, but the blue returns on cooling; it is reddened by alkalies. The fastness is increased by after-treatment with copper sulphate, but the shade is rendered duller and greener. Light: 3; with Cu. 3–2. The wool and silk in unions are dyed redder shades than cotton.

	Used largely for dyeing cotton and in calico printing. The direct shade and the coppered shade are discharged white by hydrosulphite on cotton. One of the best direct blues.	
Benzoazurine 3G (Lev) (A) (By) (K) (L) (OeV) Cotton Blue 3G, 5G, (SCI) Diamine Blue AZ (C) Sodium salt of dimethoxy-diphenyl-disazo-bis-α-naphthol-5-sulphonic acid. No. 503 (411)	A blackish-grey powder. H_2O: bluish-violet solution. $\lambda = 559.2$. Alcohol: violet solution. HCl to aqueous solution: bluish-violet precipitate. NaOH: violet-red solution. H_2SO_4: blue solution, violet precipitate on dilution. Dyes cotton direct level blue, not so green as No. 502, but the shade obtained by after-treatment with copper sulphate is duller and greener than No. 502. The dyed shade is converted into red by heating, but the blue colour returns on cooling. Light: 3–4. Used also in calico printing. The direct shade is discharged white by hydrosulphite on cotton.	
Congo Blue 2B (JBS) (LDC) (A) (By) Sodium salt of dimethoxy-diphenyl-disazo-3:6-disulpho-β-naphthol-α-naphthol-4-sulphonic acid. No. 504 (412)	A brown powder with a metallic lustre. In water: $\lambda = 572.0$. H_2O: blue solution. Alcohol: insoluble. HCl to aqueous solution: dark blue precipitate. NaOH: magenta-red solution. H_2SO_4: blue solution, blue precipitate on dilution. HNO_3: violet. Dyes cotton direct blue, rendered fast to light and washing by after-treatment with copper sulphate. Light: 3–4. Used also in calico printing. The direct shade is discharged white by hydrosulphite on cotton.	
Titan Blue 3B (H) Sodium salt of dimethoxy-diphenyl-disazo-3:6-disulpho-β-naphthol-α-naphthol-4:7-disulphonic acid. No. 505	Dyes cotton direct rather dull blue of moderate fastness to light and washing. Light: 3–4. $\lambda = 579.5$.	
Direct Violet BB (SCI) Sodium salt of dimethoxy-diphenyl-disazo-4-sulpho-1:7-dihydroxy-naphthalene-*m*-toluylene-diamine. No. 506 (413)	A greenish-black powder. H_2O: violet solution. Alcohol: deep red solution. HCl to aqueous solution: bluer solution. NaOH: red solution. H_2SO_4: blue solution, blue precipitate on dilution, HNO_3: *id.* Dyes cotton direct bluish-violet. Light: 3–4.	

Indazurine B (SCI) Sodium salt of dimethoxy-diphenyl-disazo-4-sulpho-1:7-dihydroxy-naphthalene-β-naphthol-3:6-disulphonic acid. No. 507 (414)	A black-blue powder. H_2O: reddish-blue solution. λ: points to mixtures. Alcohol: very sparingly soluble, with a reddish-blue colour. HCl to aqueous solution: bluer solution. NaOH: red solution. H_2SO_4: greenish-blue solution, reddish-blue precipitate on dilution. HNO_3: *id.* Dyes cotton direct reddish-blue. Light: 3–4.	
Direct Brilliant Blue G, (NCW) Naphthamine Brilliant Blue G, (K) Dianil Blue G (MLB) Sodium salt of dimethoxy-diphenyl-disazo-bis-1:8-dihydroxynaphthalene-3:6-disulphonic acid. No. 508 (415)	A blue powder. In water: about $\lambda = 579.5$. H_2O: blue solution. HCl: unaltered. NaOH: unaltered. H_2SO_4: blue solution, unaltered on dilution. Dyes cotton direct greenish-blue. Light: 3–4. Used also in calico printing. Discharged white by hydrosulphite on cotton.	
Chlorazol Brilliant Blue 8B 10B, *12B, R (H)* Naphthamine Blue 10B (K) Sodium salt of dimethoxy-diphenyl-disazo-bis-8-chloro-α-naphthol-5-sulphonic acid. No. 510 (417)	A bluish-black powder. H_2O: violet solution. λ: not distinct: about 578. Alcohol: insoluble. HCl to aqueous solution: violet precipitate. NaOH: crimson solution. H_2SO_4: greenish-blue solution, violet precipitate on dilution. HNO_3: blue. Dyes cotton direct blue, fast to light when after-treated with copper sulphate. Light: 4. Used also in calico printing. The direct shade is discharged white by hydrosulphite on cotton.	
Brilliant Azurine 5G (A) (By) (L) Sodium salt of dimethoxy-diphenyl-disazo-bis-1:8-dihydroxy-naphthalene-4-sulphonic acid. No. 509 (416)	A greyish-black powder. H_2O: bluish-violet solution. λ: Mixture blue + violet. Alcohol: sparingly soluble. HCl to aqueous solution: blue precipitate. NaOH: red solution. H_2SO_4: greenish-blue solution, dark reddish-blue precipitate on dilution. HNO_3: *id.* Dyes cotton direct brilliant greenish-blue, rendered greener by after-treatment with copper sulphate. Light: 3–4. Used also in calico printing. The direct shade is discharged white by hydrosulphite on cotton.	
Brilliant Azurine B (By) *Diamine Brilliant Blue G,* (C)	A greyish-blue powder. H_2O: bluish-violet solution. $\lambda = 583.5$. Alcohol: insoluble. HCl to aqueous solution: soluble reddish-violet precipitate. NaOH: cherry-red solution.	

Naphthazurine BX (K) Sodium salt of dimethoxy-diphenyl-disazo-bis-8-chloro-α-naphthol-3:6-disulphonic acid. No. 511 (418)	H_2SO_4: greenish-blue solution; violet solution on dilution. HNO_3: *id.* Dyes cotton direct reddish-blue to indigo-blue, moderately fast to light and washing, and not sensitive to acids or alkalies. The shade is rendered very fast to light, and the fastness to washing is increased by after-treatment with copper sulphate. Light: 3–4. Used also in calico printing. The direct shade is discharged moderately white by hydrosulphite on cotton, but the discharge is improved greatly by the presence of leucotrope.	
Chlorazol Blue RW (BDC) Chicago Blue RW (A) Benzo Blue RW (By) Diamine Blue RW (C) Oxydiamine Blue R (C) Sodium salt of dimethoxy-diphenyl-disazo-5-7-disulpho-8-amino-1-napthol-β-naphthol. No. 512 (419)	A blue powder. H_2O: blue solution. Alcohol: blue solution. HCl to aqueous solution: blue precipitate. NaOH: violet solution. H_2SO_4: green solution, violet precipitate on dilution. HNO_3: red. Dyes cotton direct level blue, rendered fast to light by after-treatment with copper sulphate and wool from a boiling neutral bath, rendered fast to light by after-treatment with copper sulphate. Used largely for dyeing cotton, wool, silk and unions, as it is the brightest direct medium blue; also in calico printing. Light: 3–4. The direct shade is discharged white by hydrosulphite on cotton.	
Azidine Wool Blue B (CJ) Sodium salt of dimethoxy-diphenyl-disazo-8-sulpho-β-naphthol-8-amino-1-naphthol-5-sulphonic acid. No. 513 (420)	A dark powder. H_2O: blue solution. $\lambda = 584.5$. Alcohol: blue solution. HCl to aqueous solution: blue precipitate. NaOH: more violet solution. H_2SO_4: greenish-blue solution, dark blue precipitate on dilution. HNO_3: *id.* Dyes cotton direct and wool from a boiling neutral bath greenish-blue. The shade is rendered fast to light and milling by after-treatment with copper sulphate. Light: 3–2.	
Zambesi Black BR (A) Sodium salt of dimethoxy-diphenyl-disazo-3-sulpho-7-amino-1-naphthol-8-amino-1-naphthol-5-sulphonic acid. No. 514	A grey-black powder. H_2O: dark bluish-violet solution. Alcohol: sparingly soluble with a bluish-violet colour. HCl to aqueous solution: violet precipitate. NaOH: unaltered. H_2SO_4: bluish-green solution; violet solution and then violet precipitate on dilution. HNO_3: *id.* Dyes cotton direct from a neutral or faintly alkaline bath blue, converted	

	into fast black by diazotisation on the fibre and development with *m*-toluylenediamine or with β-naphthol or by development with diazotised *p*-nitroaniline; the fastness to light and washing is increased by after-treatment with copper sulphate, or with a mixture of copper sulphate and dichromate. Light: 2.	
Niagara Blue R (*NAC*) Sodium salt of dimethoxy-diphenyl-disazo-3-sulpho-5-amino-1-naphthol-a-naphthol-4-sulphonic acid. No. 515 (421)	A grey powder. H_2O: dark blue solution. Alcohol: sparingly soluble with a violet colour. HCl to aqueous solution: faint violet solution. NaOH: reddish-violet solution. H_2SO_4: bluish-green solution; violet solution and then violet precipitate on dilution. HNO_3: blue. Dyes cotton direct indigo-blue of good fastness to light and washing. Used also in calico printing. Discharged white by hydrosulphite on cotton.	
Chicago Blue B (A) (By) *Diamine Blue CB* (C) Sodium salt of dimethoxy-diphenyl-disazo-bis-8-amino-1-naphthol-5-sulphonic acid. No. 516 (423)	A blue powder. H_2O: blue solution. $\lambda = 617.5$. Alcohol: blue solution. HCl to aqueous solution: bluish-violet precipitate. NaOH: blue solution. H_2SO_4: bluish-green solution; blue solution and then bluish-violet flocculent precipitate on dilution. HNO_3: *id.* Dyes cotton direct level blue, rendered fast to light by after-treatment with copper sulphate and rendered faster to washing by development with diazotised *p*-nitroaniline. Light: 3–4. Used also in calico printing. The direct shade is discharged white by hydrosulphite on cotton.	
Chicago Blue 4B (A) **Benzo Pure Blue 4B** (By) **Diamine Pure Blue C4B** (C) Sodium salt of dimethoxy-diphenyl-disazo-5:7-disulpho-8-amino-1-naphthol-8-amino-1-naphthol-5-sulphonic acid. No. 517 (422)	A blue powder. In water: $\lambda = 599.1.$ and 654.5. H_2O: blue solution. HCl: unaltered. NaOH: violet solution. H_2SO_4: green solution; blue solution on dilution. HNO_3: *id.* Dyes cotton direct level greenish-blue, rendered fast to light by after-treatment with copper sulphate. Light: 4–3.	
Chlorazol Sky Blue	A blue powder. H_2O: pure blue solution. $\lambda = 648.1$.	

FF (BDC) **Direct Sky Blue** 6B conc, FF, green shade (StD) (NCW) (SCI) Diphenyl Brilliant Blue FF (Gy) Chicago Blue 6B (A) Oxamine Sky Blue 6B, (B) Brilliant Benzo Blue 6B, (By) Naphthamine Blue 12B (K) Renol Light Blue (tM) Sodium salt of dimethoxy-diphenyl-disazo-bis-8-amino-1-naphthol-5:7-disulphonic acid. No. 518 (424)	Alcohol: insoluble. HCl to aqueous solution: unaltered. NaOH: bluish-violet solution. H_2SO_4: bluish-green solution; pure blue solution on dilution. Dyes cotton direct level blue, converted into a fine greenish-blue by after-treatment with copper sulphate (C below). Light: 3–4. **It is the brightest direct pure blue.** Used also for dyeing wool, silk, unions, linen and artificial silk; also in calico printing. The direct shade and the coppered shade are discharged white by hydrosulphite on cotton. **Although the purest blue, it is very dull compared with methylene blue.**	
Congo Cyanine 3B (A) **Benzo Cyanine 3B** (By) **Diamine Cyanine 3B** (C) Sodium salt of dimethoxy-diphenyl-disazo-3:6-disulpho-8-amino-1-naphthol-8-amino-1-naphthol-5-sulphonic acid. No. 519 (425)	A blue powder. H_2O: blue solution. λ = not sharp. HCl: soluble blue precipitate. NaOH: soluble blue precipitate. H_2SO_4: greenish-blue solution, blue precipitate on dilution. HNO_3: *id.* Dyes cotton direct from a neutral or faintly alkaline Glauber's salt bath pure blue, rendered faster to light by after-treatment with copper salts. Light: 4–3.	
Direct Sky Blue conc, (AJ) (JCO) (NCW) (CCC) Benzo Sky Blue (LDC) (By)	A bluish-black powder. H_2O: pure blue solution. In water λ = about 634.2 and 589.5. Alcohol: insoluble. HCl to aqueous solution: unaltered. NaOH: redder and duller solution. H_2SO_4: bluish-	

Congo Sky Blue (Lev) (A) Oxamine Sky Blue 5B (B) Triazol Blue 4B (GrE) Naphthamine Blue 7B (K) Dianil Blue H6G (MLB) Renol Sky Blue (tM) Sodium salt of dimethoxydiphenyl-disazo-bis-8-amino-1-naphthol-3:6-disulphonic acid. No. 520 (426)	green solution; pure blue solution on dilution. HNO_3: *id.* Dyes cotton direct from an alkaline bath, pure blue, rendered duller but rather faster to washing by after-treatment with copper sulphate; the fastness to light is not increased in this case by after-treatment with copper sulphate. Light: 4–3. Used also in calico printing. The direct shade is discharged white by hydrosulphite on cotton.	
Zambesi Blue B, BX (Lev) (A) Sodium salt of dimethoxy-diphenyl-disazo-3-sulpho-7-amino-1-naphthol-2-hydroxy-3-naphthoic acid. No. 521	*Zambesi Blue BX*— A pale grey powder. H_2O: blue solution. HCl: blue precipitate. NaOH: redder solution. H_2SO_4: bluish-green solution, blue precipitate on dilution. Dyes cotton direct from a faintly alkaline salt bath and diazotised on the fibre and developed with β-naphthol, navy to indigo-blue, moderately fast to light, and fast to washing, alkalies and acids. Light: 4.	No longer manufactured.
Indazurine GM (SCI) Sodium salt of dimethoxy-diphenyl-disazo-5-sulpho-7-carboxy-2:8-dihydroxy-naphthalene-α-naphthol-4-sulphonic acid. No. 522 (427)	A greenish-black powder. H_2O: reddish-blue solution. λ = mixture. Alcohol: sparingly soluble, with a bluish-violet colour. HCl to aqueous solution: unaltered. NaOH: reddish-violet solution. H_2SO_4: greenish-blue solution, violet precipitate on dilution. HNO_3: *id.* Dyes cotton direct blue. Light: 4–3.	
Direct Blue B (SCI) Sodium salt of dimethoxy-diphenyl-disazo-3-sulpho-6-carboxy-1:7-dihydroxynaphthalene-α-naphthol-4-sul-	A dark grey powder with a faint metallic lustre. H_2O: bluish-red solution. λ: mixture. Alcohol: sparingly soluble. HCl to aqueous solution: blackish-blue precipitate. NaOH: reddish-violet solution. H_2SO_4: greenish-blue solution,	

phonic acid. No. 523 (428)	violet precipitate on dilution. HNO_3: *id.* Dyes cotton direct blue of moderate fastness. Light: 4.	
Indazurine BB (*SCI*) Sodium salt of dimethoxy-diphenyldisazo-5-sulpho-7-carboxy-2:8-dihydroxynaphthalene-β-naphthol-3:6-disulphonic acid. No. 524 (429)	A blackish-blue powder. In water: $\lambda = 581.0$. H_2O: reddish-blue solution. Alcohol: sparingly soluble with a reddish-blue colour. HCl to aqueous solution: rather bluer solution. NaOH: red solution. H_2SO_4: greenish-blue solution; blue precipitate on dilution. HNO_3: *id.* Dyes cotton direct blue. Light: 4.	
Indazurine 5GM (*SCI*) Sodium salt of dimethoxy-diphenyldisazo-5-sulpho-7-carboxy-2:8-dihydroxynaphthalene-8-amino-1-naphthol-3:6-disulphonic acid. No. 525 (430)	A greenish-black powder. In water: $\lambda = 585.0$. H_2O: pure blue solution. Alcohol: insoluble. HCl to aqueous solution: unaltered. NaOH: redder solution. H_2SO_4: bluish-green solution; bluish-violet solution on dilution. HNO_3: blue. Dyes cotton direct greenish-blue. Light. 4–3. Used especially for printing.	
Naphthylene Red (*B*) Sodium salt of naphthalene-1:5-disazo-bis-α-naphthylamine-4-sulphonic acid. No. 526	A brownish-red powder. H_2O: red solution. λ: not sharp. HCl: violet-black precipitate. NaOH: unaltered. H_2SO_4: blue solution, bluish-black precipitate on dilution. HNO_3: *id.* Dyes cotton direct red from a boiling alkaline bath. Light: 4–3.	
Diamine Gold (C) Sodium salt of 3:7-disulpho-naphthalene-1:5-disazo-bis-phenetole. No. 527 (431)	An orange-yellow powder which crystallises from alcohol in fine yellowish-red needles. H_2O: orange-yellow solution, hot. Alcohol: yellow solution. HCl to aqueous solution: brown precipitate, blackened by a large excess. NaOH: soluble gelatinous orange-yellow precipitate. H_2SO_4: reddish-violet solution, green precipitate and then brown precipitate on dilution. HNO_3: blue. Dyes cotton direct from an alkaline salt bath pure yellow, fast to light, acids, alkalies and chlorine, and not sensitive to copper. Light: 2. Used largely in calico printing on account of the ease with which it is discharged. Similar to chrysophenine.	
Naphthylene Violet (C) Sodium salt of 3:7-disulpho-naphthalene-1:5-disazo-bis-α-naphthylamine.	*Naphthylene Violet*— A brown powder. H_2O: Bordeaux red solution. λ: not distinct. HCl: blue precipitate. NaOH: soluble red precipitate. H_2SO_4: blue solu-	

No. 528 (432)	tion, violet precipitate on dilution. HNO_3: *id.* Dyes cotton direct from a faintly alkaline salt bath violet, converted into a handsome cutch-brown, very fast to washing, moderately fast to light and chlorine, and not sensitive to acids and alkalies by tetrazotisation on the fibre and treatment with a hot soda solution. A darker and more bluish-brown of good fastness to washing, acids and alkalies and moderately good fastness to light, is obtained by tetrazotisation on the fibre and development with *Fast Blue Developer* AD (C) (aminodiphenylamine). Light: 2–3. Silk is dyed in acidified boiled-off liquor or with acetic acid, and is developed in a similar manner.	
Coomassie Black B (Lev) Sodium salt of 3-sulpho-naphthalene-1:4-disazo-3:6-disulpho-β-naphthol-β-naphthylamine. No. 529 (433)	A black powder. H_2O: blue-black solution. Alcohol: insoluble. HCl to aqueous solution: violet solution. NaOH: unaltered. H_2SO_4: greenish-blue solution; dull red solution on dilution. HNO_3: *id.* Dyes wool deep black from an acid bath. Light: 2–3.	No longer manufactured.
Coomassie Navy Blue (Lev) Sodium salt of 3-sulpho-naphthalene-1:4-disazo-3:6-disulpho-β-naphthol-β-naphthol. No. 530 (434)	A black-blue powder. H_2O: dark blue solution. HCl: unaltered. NaOH: violet solution. H_2SO_4: bluish-green solution; dark blue solution on dilution. HNO_3: dull green. Dyes wool from an acid bath, or wool and silk from a neutral bath, navy-blue. Light: 3.	No longer manufactured.
Chrome Patent Green A (K) Sodium salt of benzene-azo-4:6-disulpho-1-amino-8-naphthol-azo-α-naphthalene-azo-salicylic acid. No. 531	A chocolate-brown powder. H_2O: greenish-blue solution. λ: $\left.\begin{matrix}643.8\\592.2\end{matrix}\right\}$ A HCl: bluish-black precipitate. NaOH: bluish-violet precipitate. H_2SO_4: green solution; greenish-blue solution and then black precipitate on dilution. HNO_3: *id.* Dyes wool from an acid bath and after-chromed moderately bright deep bluish-green of good fastness to light, milling, alkalies and acids. Light: 2–3.	
Diazo Fast Green BL (By)	A dark greenish-black powder. H_2O: dark bluish-green solution. λ: not distinct.	

Sodium salt of 7-sulpho-4-amino-α-naphthalene-azo-6-sulpho-α-naphthalene-azo-3-sulpho-α-naphthol-7-azo-methyl-ketol. No. 532	Alcohol: insoluble. HCl to aqueous solution: dark blue precipitate. NaOH: greenish-blue precipitate. H_2SO_4: dark bluish-black solution; violet-black solution and then violet-black precipitate on dilution. Dyes cotton direct green, rendered by diazotisation on the fibre and development with β-naphthol slightly bluer, and of excellent fastness to light and washing. Light: 2. Used also in calico printing. Discharged white by hydrosulphite on cotton.	
Benzo Light Blue 2GL 2. 5-Aniline-di-sulpho-acid-Cleve acid-α-naphthylamine-phenyl-J-acid **Benzo Light Blue BL,** similar, but instead of anilinedisulpho-acid, *metanilic* acid.	*Benzo Fast Blue* FR— A black powder. H_2O: deep blue solution. HCl: blue precipitate. NaOH: violet blue precipitate. H_2SO_4: greenish-black solution; violet solution and then wine-red precipitate on dilution. Dyes cotton direct from an alkaline bath level blue of good fastness to light (2). Suitable for dyeing artificial silk and scarcely stains the animal fibres in unions and half-silk. Used also in calico printing. Discharged white by hydrosulphite on cotton. Very important dyes.	2Zh; λ = 594,0 Bh, λ = 5F9,5 similar 4ZL; λ = 606,0 8Zh.; λ = 632,0 See also Fierz, *Dyestuffs*, 1926, pp. 159–161.
Naphthogene Blue 4R (A) Sodium salt of 4:8-disulpho-β-naphthalene-azo-7-sulpho-α-naphthalene-azo-*p*-cresol-methyl-ether-azo-*p*-xylidine. No. 534	A dark brown powder. H_2O: reddish-violet solution. λ: not sharp. HCl: dark blue precipitate. NaOH: soluble dark violet precipitate. H_2SO_4: blackish-green solution, dark blue precipitate on dilution. HNO_3: *id.* Dyes cotton direct from a faintly alkaline salt bath, and diazotised on the fibre and developed with β-naphthol, indigo-blue. Light: 2. Used also in calico printing. Discharged white by hydrosulphite on cotton.	
Janus Brown B (MLB) **Union Brown A** (MLB) Chloride of *m*-trimethylaminobenzene-azo-α-naphthalene-aoz *m*-diamino-benzene-azo-benzene. No. 535 (435)	*Janus Brown B*— A black powder H_2O: brown solution. HCl: soluble brown precipitate. NaOH: brown precipitate. H_2SO_4: dark green solution; reddish-brown solution and then brown solution on dilution. Dyes cotton mordanted with tannin and tartar emetic, or cotton direct with an after-treatment with tannin,	

	brown; unions are dyed from an acid bath. Light: 5–4. Used for dyeing cotton, unions, paper, &c.	
Janus Brown R (MLB) *Union Brown R* (MLB) Hydrochloride of *p*-diethylamino-benzylzo-α-anaphthalene-azo-*m*-diaminobenzene-azo-benzene. No. 536 (435)	*Janus Brown R*— A black powder. H_2SO: brown solution. HCl: soluble brown precipitate. NaOH: brown precipitate. H_2SO_4: navy-blue solution; reddish-brown solution and then brown solution on dilution. HNO_3: *id.* Dyes cotton mordanted with tannin and tartar emetic, or cotton direct with an after-treatment with tannin, brown; unions are dyed from an acid bath. Light: 4–3. Used for dyeing cotton, unions, paper, &c.	
Titan Black J (H) Sodium salt of 6 or 7-sulpho-4-amino-α-naphthalene-azo-benzene-azo-3-sulpho-1-naphthol-6-azo-*m*-phenylene-diamine. No. 537	A black powder. H_2O: violet-black solution. HCl: blue-black precipitate. NaOH: redder solution. H_2SO_4: dark green solution, blue-black precipitate on dilution. HNO_3: blue. Dyes cotton direct from a faintly alkaline or neutral salt bath grey to black, moderately fast to washing, and of good fastness to acids and alkalies. Light: 3–4.	
Oxydiamine Black N (C) Sodium salt of 3-sulpho-7-amino-1-naphthal-2-azo-benzene azo-3-sulpho-1-naphthol-7-azo-*m*-phenylenediamine. No. 538	A black powder. H_2O: blue-black solution. HCl: blackish-violet precipitate. NaOH: reddish-violet precipitate. H_2SO_4: greenish-blue solution, violet-black precipitate on dilution. HNO_3: *id.* Dyes cotton direct from a faintly alkaline salt bath bluish-black, moderately fast to washing, and of good fastness to acids and alkalies, converted into brown by development on the fibre with diazotised *p*-nitro-aniline. Light: 3–2. Used also in calico printing. The direct shade is discharged white by hydrosulphite on cotton.	
Chlorazol Black FFH (BDC) Chloramine Black FF, FF extra, (S) Columbia Black FB, FF extra (A)	A brown-black powder. H_2O: violet-black solution. Alcohol: insoluble. HCl: to aqueous solution: violet precipitate. NaOH: violet precipitate. H_2SO_4: blue solution, violet precipitate on dilution. HNO: *id.* **Not sensitive to dil. acid or alkali.** Dyes cotton direct black, rendered faster to washing by after-treatment with formaldehyde (F below).	

Pluto Black F extra (By) Naphthamine Direct Black FFK extra, (K) Patent Dianil Black FF extra, (MLB) Sodium salt of 6 or 7-sulpho-4-amino-α-naphthalene-azo-benzene-azo-3-sulpho-1-naphthol-7-azo-*m*-phenylenediamine. No. 539 (436)	Used also in calico printing. Light: 2–3. Discharged moderately white by hydrosulphite on cotton, but the discharge is improved by the presence of leucotrope. Important for linings. F.F. with *m*-phenylenediamine. F.B. with *m*-toluylenediamine.	
Isodiphenyl Black R (*Gy*) *m*-Dihydroxybenzene-azo-benzene-azo-3-sulpho-1-naphthol-7-azo-*m*-phenylenediamine. No. 540 (437)	A greyish-black powder. H_2O: sparingly soluble cold, soluble hot with a violet-black colour. Alcohol: violet-black solution hot. HCl to aqueous solution: bluish-black precipitate. NaOH: redder solution and black precipitate. H_2SO_4: blackish-blue solution, black precipitate on dilution. HNO_3: *id.* Dyes cotton direct black, not fast to light, but moderately fast to washing and of good fastness to acids and alkalies. The fastness to washing is increased considerably by after-treatment with formaldehyde. *Isodiphenyl Black R* was the first dye for which this treatment was recommended. Light: 3. Used also for dyeing unions from a single bath.	*Not made.*
Naphthamine Direct Black B, CS, FF, FG, (*K*) Sodium salt of *m*-phenylenediamine-azo-3-sulpho-benzene-4-azo-6- or 7-sulpho-α-naphthalene-azo-*m*-phenylenediamine. No. 541 (458)	A dark brown powder. H_2O: violet-black solution. Alcohol: insoluble. HCl to aqueous solution: bluish-violet precipitate. NaOH: blue solution. H_2SO_4: bluish-green solution, bluish-violet precipitate on dilution. HNO_3: *id.* Dyes cotton direct from a Glauber's salt bath black, of good fastness to light and acids. Light: 2–3.	
Para Bronze NB, NG, V extra, (*By*)	*Para Bronze NB*— A greyish-black powder. H_2O: dark brown solution.	

Sodium salt of *m*-dihydroxy-benzene-azo-benzene-*m*-azo-3:6-disulpho-1-naphthol-8-azo-*m*-dihydroxy-benzene. No. 542	Alcohol: insoluble. HCl to aqueous solution: brown precipitate. NaOH: reddish-brown solution. H_2SO_4: blackish-brown solution, brown precipitate on dilution. HNO_3: *id.* Dyes cotton direct brown, rendered fast to light and washing by development on the fibre with diazotised *p*-nitroaniline. Light: 3. Used also in calico printing. Discharged white by hydrosulphite on cotton.	
Diamine Fast Bordeaux (C) Diamine Brilliant Bordeaux R (C) Naphthamine Brilliant Bordeaux ABH (K) Sodium salt of *m*-dihydroxy-benzene-azo-benzene-*m*-azo-3-sulpho-1-naphthol-6-azo-*m*-dihydroxy-benzene. No. 543	A maroon powder. H_2O: claret-red solution. λ: mixtures. HCl: dark blue precipitate. NaOH: yellower solution. H_2SO_4: dark blue solution, dark blue precipitate on dilution. HNO_3: *id.* Dyes cotton direct claret-red, rendered fast to washing by after-treatment with formaldehyde, without material alteration of the shade. Light: 3. Used for dyeing unions and in calico printing. Discharged white by hydrosulphite on cotton.	
Pluto Black 5BS extra (By) Sodium salt of diphenylamine-*p*-azo-*m*-phenylenediamine-*p*-azo-3-sulpho-1-naphthol-7-azo-7-amino-1-naphthol-3-sulphonic acid. No. 544	*Pluto Black 5BS extra*— A black powder. H_2O: dull reddish-black solution. HCl: dull reddish-black precipitate. NaOH: dull wine-red precipitate. H_2SO_4: blue-black solution; violet solution and then reddish-black precipitate on dilution. HNO_3: *id.* *Diamine Jet Black SS*— A grey powder. H_2O: violet-black solution. HCl: violet-black precipitate. NaOH: dull wine-red solution. H_2SO_4: violet-black solution; violet solution and then violet-black precipitate on dilution. HNO_3: *id.* Dyes cotton direct from an alkaline bath black, fast to cross-dyeing. Light: 2–3. Used for dyeing cotton in unions during milling; also in calico printing.	

	Discharged white by hydrosulphite on cotton.	
Plutoform Black L, 3GL, (By) Sodium salt of diphenylamine-*p*-azo-*m*-amino-phenylglycine-*p*-azo-3-sulpho-1-naphthol-7-azo-*m*-aminophenylglycine. No. 545 Similar: Formal Fast Black, but *not* identical.	*Plutoform Black L*— A black powder. H_2O: brownish-black solution hot. HCl: black precipitate. NaOH: reddish-brown precipitate. H_2SO_4: violet-black solution; violet solution and then brownish-black precipitate on dilution. *Plutoform Black 3GL*— A greyish-black powder. H_2O: violet-black solution, hot. HCl: violet-black precipitate. NaOH: wine-red solution and precipitate. H_2SO_4: reddish-black solution; violet solution and then violet-black precipitate on dilution. Dyes cotton direct black, fast to washing by after-treatment with formaldehyde. Used also in calico printing. Discharged white by hydrosulphite on cotton. Very important for thread (Coats).	
Oxamine Violet GRF (*R*) Sodium salt of diphenyl-azo-3:6-disulpho-β-naphthol-azo-*m*-phenylene-oxamic-acid-azo-*m*-phenylenediamine. No. 546	A bronzy powder. H_2O: readily soluble. HCl: reddish-violet precipitate. NaOH; cherry-red solution. H_2SO_4: blue solution, violet precipitate on dilution. Dyes cotton direct reddish-violet from a salt bath. Light: 3–4.	
Oxamine Black MB (R) Sodium salt of diphenyl-azo-*m*-phenylene-oxamic-acid-disazo-bis-7-amino-1-naphthol-3-sulphonic acid. No. 547	A bronzy powder. H_2O: readily soluble. Alcohol: very sparingly soluble. HCl to aqueous solution: blackish-blue precipitate. NaOH: violet-black precipitate. H_2SO_4: pure blue solution, reddish-violet precipitate on dilution. Dyes cotton direct from an alkaline salt bath black, converted into a fine deep black by diazotisation on the fibre and development with *m*-toluylenediamine. Light: 3–2.	Scarcely used.
Oxamine Violet RR (R) Sodium salt of diphenyl-azo-*m*-phenylene-oxamic-acid-disazo-bis-α-naphthol-4-sulphonic acid. No. 548	A dark bronzy powder. H_2O: bluish-blue solution. Alcohol: soluble. HCl to aqueous solution: bluish-red precipitate. NaOH: violet-red solution. H_2SO_4: blue solution, violet precipitate on dilution. HNO_3: *id.* Dyes cotton direct violet from an alkaline salt bath. Light: 3.	
Diamine Beta Black B, BB, BGH,	A bluish-black powder. In water: λ = about 575.0.	

(C) Sodium salt of diphenyl-azo-*p*-xylene-disazo-bis-8-amino-1-naphthol-3:6-disulphonic acid. No. 549 (438)	H_2O: bluish-violet solution. Alcohol: insoluble. HCl to aqueous solution: violet precipitate. NaOH: violet solution. H_2SO_4: blue solution, blue-violet precipitate on dilution. HNO_3: blue. Dyes cotton direct from an alkaline salt bath black-blue, converted by diazotisation on the fibre and development with β-naphthol into a fine black, fast to washing and moderately fast to light, dilute acids and alkalies; dark green is obtained by development with resorcinol, and brownish-black by development with *m*-phenylenediamine. Light: 2–3.	
Direct Indigo Blue—(SCI) Sodium salt of diphenyl-azo-*p*-cresol-methyl-ester-disazo-bis-8-amino-1-naphthol-3:6-disulphonic acid. No. 550 (439)	A grey powder. H_2O: blue solution. Alcohol: insoluble. HCl to aqueous solution: soluble blue precipitate. NaOH: soluble blue precipitate. H_2SO_4: blue solution; blue solution and blue precipitate on dilution. HNO_3: blue-black solution. Dyes cotton direct from a slightly alkaline Glauber's salt bath, or unions and half-silk from a slightly acid (acetic acid) Glauber's salt bath, indigo-blue, moderately fast to light, washing, alkalies, and acids. Silk is not dyed so deeply as cotton. When diazotised on the fibre and developed with β-naphthol or *m*-toluylenediamine, black is obtained. Light: 2–3. Used also in calico printing. Discharged white by hydrosulphite or chlorate on cotton.	Scarcely used.
Direct Indigo Blue BK (SCI) Sodium salt of diphenyl-azo-*p*-cresol-methyl-ether-disazo-bis-7-amino-1-naphthol-3-sulphonic acid. No. 551 (440)	A bluish-grey powder. H_2O: violet solution. λ: mixture. Alcohol: insoluble. HCl to aqueous solution: violet precipitate. NaOH: reddish-violet solution. H_2SO_4: blue solution, violet precipitate on dilution. Dyes cotton direct from a bath containing 20% of Glauber's salt and 2% of soda, and unions from a bath containing 15–20% of Glauber's salt and 2% of acetic acid indigo-blue of good fastness to light, acids and alkalies. When diazotised on the fibre and developed with *m*-toluylenediamine or β-naphthol, black is obtained. Light: 3. Used also in calico printing. Discharged white by hydrosulphite on cotton.	
Diazo Blue-Black RS (By)	*Diazo Blue-black* RS— A grey powder.	

Sodium salt of diphenyl-azo-α-naphthalene-disazo-bis-8-amino-1-naphthol-3:6-disulphonic acid. No. 552 (441)	H_2O: dark blue solution. HCl: blue precipitate. NaOH: redder solution. H_2SO_4: dark bluish-green solution, blue precipitate on dilution. Dyes cotton direct level dark greenish-blue, fast to rubbing, ironing, alkalies and acids, converted by diazotisation on the fibre and development with β-naphthol into grey to blue-black, fast to washing. Wool is dyed from a boiling neutral bath dark blue, fast to milling and alkalies. Light: 3–2. Used also for dyeing unions and half-silk.	
Direct Black V (S) Diazo Direct Black (FB) Sodium salt of diphenyl-azo-3-sulpho-7-amino-1-naphthol-azo-3:6-disulpho-1-naphthol-7-azo-α-naphthylamine. No. 553 (442)	A greyish-black powder. H_2O: violet-black solution. Alcohol: insoluble. HCl to aqueous solution: blue-black precipitate. NaOH: reddish-violet solution. H_2SO_4: blue solution, blue-black precipitate on dilution. HNO_3: *id.* Dyes cotton direct violet-black of good fastness to washing, acids and alkalies, and moderately fast to light. When diazotised on the fibre and developed, dark blue is obtained with β-naphthol and deep black with *m*-toluylenediamine; very fast to washing. Light: 2–3.	Scarcely used.
Direct Indone Blue R (S) Sodium salt of diphenyl-azo-3:6-disulpho-8-amino-1-naphthol-azo-3:6-disulpho-1-naphthol-7-azo-α-naphthylamine. No. 554 (443)	A bluish-black powder. In water: $\lambda = 591.0$. H_2O: bluish-black solution. Alcohol: insoluble. HCl to aqueous solution: dark blue precipitate. NaOH: violet solution. H_2SO_4: blue solution, dark blue precipitate on dilution. HNO_3: *id.* Dyes cotton direct greyish-blue to indigo-blue of good fastness to light and washing. When diazotised on the fibre and developed, fast black-blue is obtained with β-naphthol, and fast black with *m*-toluylenediamine. Light: 2–3.	
Crumpsall Direct Fast Brown B (*Lev*) Sodium salt of diphenyl-azo-salicylic-acid-azo-*p*-xylene-azo-7-amino-1-naphthol-3-sulphonic acid. No. 555 (444)	A blackish-brown powder. H_2O: brown solution. Alcohol: soluble, HCl to aqueous solution: redder solution. NaOH: unaltered. H_2SO_4: violet solution; brown solution on dilution. HNO_3: blue. Dyes cotton direct dark brown. Light: 3. Used also in calico printing. Discharged creamy-white by hydrosulphite on cotton.	Probably not now used.
Crumpsall Direct Fast Brown O	A blackish-brown powder. H_2O: brown solution.	

(*Lev*) Sodium salt of diphenyl-azo-salicylic-acid-azo-*p*-xylene-azo-7-phenyl-amino-1-naphthol-3-sulphonic acid. No. 556 (445)	HCl: brown precipitate. NaOH: unaltered. H_2SO_4: violet solution, brown precipitate on dilution. HNO_3: *id.* Dyes cotton direct olive-brown, fast to light. (3–2.) Used also in calico printing. Discharged buff by hydrosulphite on cotton.	Probably not now used.
Benzo Grey S extra, **(LDC) (By)** Sodium salt of diphenyl-azo-salicylic-acid-azo-α-naphthalene-azo-α-naphthol-4-sulphonic acid. No. 557 (447)	A greyish-black powder. H_2O: Bordeaux-brown solution. HCl: black precipitate. NaOH: unaltered. H_2SO_4: blue solution, black precipitate on dilution. Dyes cotton direct grey, moderately fast to light and washing, and of good fastness to acids and alkalies. Light: 3–4.	
Benzo Olive (LDC) (By) **Direct Olive G** (ICA) Sodium salt of diphenyl-azo-salicylic-acid-azo-α-naphthalene-azo-8-amino-1-naphthol-3:6-disulphonic acid. No. 558 (446)	A black powder. In water: λ = 598.5 and 664.7. H_2O: dark moss-green solution. Alcohol: insoluble. HCl to aqueous solution: blackish-grey precipitate. NaOH: dark brown solution. H_2SO_4: violet solution, greenish-black precipitate on dilution. Dyes cotton direct from a neutral salt bath level greenish-olive, moderately fast to light, washing and acids, but rendered browner by alkalies; the fastness to washing is increased considerably with little alteration in shade by after-treatment with formaldehyde; the fastness to light and washing are increased by after-treatment with dichromate and copper sulphate, and the shade is converted into brownish-olive. Light: 3–4. *Benzo Olive* yields a slightly bluer shade when dyed in presence of iron. Used also in calico printing. Discharged white by hydrosulphite on cotton.	Little used.
Diamine Bronze G (LDC) (MLy) (C) **Naphthamine Olive V new,** (K) Sodium salt of diphenyl-azo-salicylic-acid-azo-3:6-disulpho-1-naphthol-8-azo-*m*-phenylene-diamine. No. 559 (448)	A black powder. H_2O: insoluble cold, chocolate-brown solution hot. HCl: brown precipitate. NaOH: yellower solution. H_2SO_4: bluish-violet solution, blackish precipitate on dilution. Dyes cotton direct yellowish-brown of metallic appearance, moderately fast to light and washing, fast to alkalies, but reddened by acids. Cotton in unions is dyed more deeply than wool or silk. The dyeings are rendered very fast to washing without alteration in shade by after-treatment with	

	chromium fluoride, whereas treatment with copper sulphate produces a deep brown, fast to light and washing. Olive shades, very fast to washing, are produced by development with diazotised *p*-nitroaniline. (*e. g.* Nitrazol C). Light: 3–4. Used largely for dyeing cotton; also in calico printing. Discharged white by hydrosulphite on cotton in the case of both the direct and developed shades.	
Cotton Dark Brown T (MLy) (C) *Direct Brown V* (*StD*) Sodium salt of diphenyl-azo-salicylic-acid-azo-3-sulpho-1-naphthol-7-azo-*m*-phenylenediamine. No. (560)	*Cupranil Brown B* (SCI)— A brownish-black powder. H_2O: dark brown solution. HCl: dark brown precipitate. NaOH: redder-brown solution. H_2SO_4: violet solution, dark brown precipitate on dilution. Dyes cotton direct from a faintly alkaline salt bath violet brown, moderately fast to light and washing, and not sensitive to acids or alkalies. The fastness to light and washing is increased by after-treatment with copper sulphate and acetic acid, and shades faster to washing are obtained by after-treatment with formaldehyde. Light: 4–3. Used for dyeing cotton and unions. Not discharged to a satisfactory white by hydrosulphite on cotton.	Scarcely used.
Trisulphon brown, B (*S*) *Chlorazol Brown LF* (*BDC*) Sodium salt of 4-sulpho-α-naphthalene-azo-3:6-disulpho-1-naphthol-7-azo-*m*-toluylene-diamine-azo-diphenyl-azo-salicylic acid. No. 561 (449)	A brown powder. H_2O: coffee-brown solution. HCl: blackish-brown precipitate. NaOH: reddish-brown solution. H_2SO_4: bluish-violet solution, dark brown precipitate on dilution. Dyes cotton direct chestnut-brown, moderately fast to light and washing, and not sensitive to acids or alkalies. After-treatment with dichromate or copper sulphate renders the dyeings very fast to washing and light without altering the shade greatly. Light: 3–2. *Trisulphon Brown B* is shaded with another dye.	
Oxamine Black MT (*R*) Sodium salt of ditolyl-azo-phenylene-oxamic-acid-disazo-bis-7-amino-1-naphthol-3-sulphonic acid. No. 562	A bronzy powder. H_2O: readily soluble. Alcohol: very sparingly soluble. HCl to aqueous solution: black-blue precipitate. NaOH: blue-black precipitate. H_2SO_4: pure blue solution, violet-black precipitate on dilution. Dyes cotton direct from a faintly alkaline Glauber's salt bath black,	

	converted into deep black by diazotisation and development on the fibre. Light: 3–4.	
Oxamine Violet MT (*R*) Sodium salt of ditolyl-azo-phenylene-oxamic-acid-disazo-bis-β-naphthoë-di-sulphonic acid. No. 563	A dark violet powder. H_2O: reddish-violet solution. Alcohol: insoluble. HCl to aqueous solution: reddish-violet solution or precipitate. NaOH: bluish-red precipitate. H_2SO_4: blue solution; reddish-violet solution, and then violet precipitate on dilution. Dyes cotton direct violet from an alkaline sat bath.	Scarcely used.
Oxamine Violet BBR (*R*) Sodium salt of ditolyl-azo-phenylene-oxamic-acid-azo-β-naphthol-azo-α-naphthol-4-sulphonic acid. No. 564	A dark bronzy powder. H_2O: readily soluble. HCl: bluish-red precipitate. NaOH: violet-red solution. H_2SO_4: blue solution, violet precipitate on dilution. Dyes cotton direct violet from an alkaline salt bath. Light: 4–3.	Scarcely used.
Oxamine Red MT (*R*) Sodium salt of ditolyl-azo-toluylene-oxamic-acid-disazo-bis-resorcinol. No. 565	A dark powder. H_2O: brownish-red solution hot. Alcohol: almost insoluble. HCl to aqueous solution: reddish-brown precipitate. NaOH: rather redder solution. H_2SO_4: blue solution, reddish-brown precipitate on dilution. Dyes cotton direct a fine brownish-red from an alkaline salt bath. Light: 3–4.	
Benzo Black-Blue R (*LDC*) (*By*) Sodium salt of ditolyl-azo-α-naphthalene-disazo-bis-α-naphthol-4-sulphonic acid. No. 566 (450)	A greyish-black powder. H_2O: bluish-violet solution. Alcohol: violet solution. HCl to aqueous solution: violet precipitate. NaOH: redder solution. H_2SO_4: blue solution, bluish-violet precipitate on dilution. Dyes cotton direct from a soap bath black-blue, moderately fast to light, washing, acids and alkalies. Light: 3–4.	
Congo Fast Blue R (A) Benzo Fast Blue R (By) Naphthamine Light Blue R, (K) Sodium salt of ditolyl-azo-α-naphthalene-dis-azo-bis-α-naph-	A blue powder. In water: about $\lambda = 572.0$. H_2O: blue solution. Alcohol: reddish-violet solution. HCl to aqueous solution: blue precipitate. NaOH: blue precipitate. H_2SO_4: blue solution, blue precipitate on dilution. Dyes cotton direct blue. Light: 3–2. Used also in calico printing. Not discharged to a satisfactory white by hydrosulphite on cotton.	

thol-3:8-disulphonic acid. No. 567 (451)		
Benzo Indigo Blue (*Lev*)(*By*) Sodium salt of ditolyl-azo-α-naphthalene-disazo-bis-1:8-dihydroxynaphthalene-4-sulphonic acid. No. 568 (452)	A grey powder. H_2O: violet solution. λ: points to mixture. Alcohol: insoluble. HCl to aqueous solution: bluish-violet precipitate. NaOH: soluble, reddish-violet precipitate. H_2SO_4: greenish-blue solution, bluish-violet precipitate on dilution. Dyes cotton direct from an alkaline Glauber's salt bath indigo-blue, moderately fast to light and washing, fast to dilute acids, but reddened by dilute alkalies. Light: 3–4. Used also in calico printing. Discharged white by hydrosulphite on cotton.	
Columbia Black R (*A*) Sodium salt of ditolyl-azo-3:6-disulpho-1-naphthol-7-disazo-bis-*m*-toluylene-diamine. No. 569 (453)	A black powder. H_2O: brownish-black solution. Alcohol: brownish-black solution. HCl to aqueous solution: black flocculent precipitate. NaOH: brown solution. H_2SO_4: pure blue solution, violet-black flocculent precipitate on dilution. Dyes cotton direct black. Light: 3. Used for dyeing all vegetable fibres; also in calico printing. Discharged white by hydrosulphite on cotton.	
Trisulphon Brown G (*S*) Sodium salt of 4-sulpho-α-naphthalene-azo-3:6-disulpho-1-naphthol-7-azo-*m*-toluylene-diamine-azo-ditolyl-azo-salicylic acid. No. 570 (454)	A brown powder. H_2O: coffee-brown solution. λ: points to mixture. HCl: blackish-brown precipitate. NaOH: reddish-brown solution. H_2SO_4: bluish-violet solution, dark brown precipitate on dilution. Dyes cotton direct yellow to brown, moderately fast to light, and washing and not sensitive to acids or alkalies. The fastness to light and washing is increased by after-treatment with dichromate or copper sulphate. Light: 3–4.	
Oxamine Blue BB (*R*) Sodium salt of di-methoxy-diphenyl-azo-2-aminobenzene-4-azo-β-naphthol-azo-α-naphthol-4-sulphonic acid.	A bronzy powder. H_2O: readily soluble. λ: points to mixture. Alcohol: blue solution, red on heating. HCl to aqueous solution: bluish-violet precipitate. NaOH: magenta-red solution. H_2SO_4: greenish-blue solution, bluish-violet precipitate on dilution.	

No. 571	Dyes cotton direct from an alkaline salt bath blue, converted into bluish-black by diazotisation and development on the fibre. Light: 3.	
Oxamine Black MO (*R*) Sodium salt of dimethoxy-diphenyl-azo-phenylene-oxamic-acid-disazo-bis-7-amino-1-naphthol-3-sulphonic acid. No. 572	A dark bronzy powder. H_2O: blue-black solution. HCl: blackish-blue precipitate. NaOH: bluish-black precipitate. H_2SO_4: bluish-green solution, blackish-blue precipitate on dilution. Dyes cotton direct from an alkaline Glauber's salt bath blue-black, converted into deep black by diazotisation and development on the fibre. Light: 3–2.	
Oxamine Blue BT (*R*) Sodium salt of dimethoxy-diphenyl-azo-phenylene-oxamic-acid-azo-*m*-phenylene-diamine-azo-*β*-naphthol-3:6-disulphonic acid. No. 573	A bronzy powder. H_2O: readily soluble. λ: points to mixtures. Alcohol: insoluble. HCl to aqueous solution: blue precipitate. NaOH: magenta-red solution. H_2SO_4: greenish-blue solution, blue precipitate on dilution. Dyes cotton direct dark reddish-blue from an alkaline salt bath. Light: 3–4.	
Oxamine Blue MD (*R*) Sodium salt of dimethoxy-diphenyl-azo-phenylene-oxamic-acid-disazo-bis-*β*-naphthol-3:6-disulphonic acid. No. 574	A black powder. H_2O: readily soluble. λ: points to mixtures. Alcohol: insoluble. HCl to aqueous solution: blue precipitate. NaOH: reddish-violet solution. H_2SO_4: greenish-blue solution, blue precipitate on dilution. HNO_3: blue. Dyes cotton direct blue from an alkaline bath. Light: 4–3.	
Columbia Black B (A) *Direct Blue-Black B, 2B,* (By) Sodium salt of dimethoxy-diphenyl-azo-3:6-disulpho-1-naphthol-7-disazo-bis-*m*-toluylenediamine. No. 575 (455)	A black powder. H_2O: violet-black solution. Alcohol: violet-black solution. HCl to aqueous solution: dark flocculent precipitate. NaOH: reddish-violet solution. H_2SO_4: blue-black solution; bluish-violet solution and then violet-black flocculent precipitate on dilution. Dyes cotton direct black. Light: 3–4. Used also in calico printing. Not discharged to a satisfactory white by hydrosulphite on cotton. **The first substantive dye to produce direct deep black shades without development on the fibre.**	No longer used.
Congo Fast Blue B (A) **Benzo Fast Blue B** (By) Sodium salt of di-	A violet-blue powder. In water: λ = about 587.0. H_2O: blue solution. Alcohol: violet-blue solution. HCl to aqueous solution: blue flocculent	

methoxy-diphenyl-azo-α-naphthalene-disazo-bis-α-naphthol-3:8-disulphonic acid. No. 576 (456)	precipitate. NaOH: blue flocculent precipitate. H_2SO_4: greenish-blue solution, dark blue precipitate on dilution. HNO_3: blue. Dyes cotton direct blue: soda should not be used in dyeing. Light: 3. Used also in calico printing. Discharged white by hydrosulphite on cotton.	
Trisulphon 2G (S) *Chlorazol Brown 2G* (*BDC*) Sodium salt of 4-sulpho-α-naphthalene-azo-3:6-disulpho-1-naphthol-7-azo-*m*-toluylene-diamine-azo-dimethoxy-diphenyl-azo-salicylic acid. No. 577 (457)	A brown powder. H_2O: brown solution. HCl: black-brown precipitate. NaOH: reddish-brown solution. H_2SO_4: bluish-violet solution, dark brown precipitate on dilution. Dyes cotton direct yellow to brown, moderately fast to light and washing, and not sensitive to acids or alkalis. After-treatment with dichromate or copper sulphate renders the shades faster to washing and light. Wool is not dyed so deeply as cotton. The shades on silk are fast to washing, stoving and carbonising. *Trisulphon Brown* 2G is shaded with a bright yellow dye. Light: 2–3. Used for dyeing cotton, wool and silk; also in calico printing. Discharged white by hydrosulphite on cotton.	
Benzo-Black-Blue G (*By*) Sodium salt of 3:3-disulpho-diphenyl-azo-a-naphthalene-disazo-bis-α-naphthol-4-sulphonic acid. No. 578 (459)	A black powder. H_2O: blue-black solution. Alcohol: insoluble. HCl to aqueous solution: black-blue precipitate. NaOH: soluble black-blue precipitate. H_2SO_4: blackish-green solution, black-blue precipitate on dilution. Dyes cotton direct from a faintly alkaline bath black-blue, moderately fast to light, washing, acids and alkalies. Light: 3–4. Used also in calico printing. Discharged white by hydrosulphite on cotton.	
Benzo Black-Blue 5G (*By*) Sodium salt of 3:3-disulpho-diphenyl-azo-a-naphthalene-disazo-bis-1:8-dihydroxynaphthalene-4-sulphonic acid. No. 579 (460)	A grey powder. H_2O: blackish-blue solution. Alcohol: insoluble. HCl to aqueous solution: dark greenish-blue precipitate and greenish solution. NaOH: unaltered. H_2SO_4: black-green solution, dark greenish-blue precipitate on dilution. Dyes cotton direct greenish-black, moderately fast to light, washing and acids, but sensitive to alkalies. Light: 3–4. Used also in calico printing.	

	Discharged creamy-white by hydrosulphite on cotton.	
Coomassie Union Black (*Lev*) Sodium salt of 3-sulpho-α-naphthalene-azo-3-sulpho-1-naphthol-disazo-bis-*m*-phenylenediamine-(or-*m*-toluylenediamine or resorcinol). No. 580 (461)	A black powder. H_2O: violet solution. HCl: unaltered. NaOH: unaltered. H_2SO_4: blue solution; black-blue solution on dilution. Dyes cotton and wool direct black.	Not placed upon the market.
Direct Black MS RL, extra conc., E, GX, EE extra conc. E extra, 2V, F, A, (AJ) (JWL) (CCC) (NCC) (VSt) (NCC) (NCW) (StCl) (StD) (T) (ICA) Chlorazol Black E extra, No. 1. (BDC) **Direct Deep Black EW extra,** EW, (SCC) (By) (MC) Union Black (By) Sodium salt of benzene-azo-3 : 6-disulpho-8-amino-1-naphthol-7-azo-diphenyl-azo-*m*-phenylenediamine. No. 581 (462)	A greyish-black powder. H_2O: greenish-brown solution. Alcohol: insoluble. HCl to aqueous solution: violet solution. NaOH: navy-blue solution. H_2SO_4: violet-blue solution. Sensitive to weak acids and alkali (red: green). Dyes cotton and unions direct black. The fastness to washing is increased by after-treatment with formaldehyde; development with diazotised *p*-nitroaniline also can be used and renders the shade fast to washing and alkalies. Light: 3–2. Used for dyeing cotton, unions, leather &c., also in calico printing. Discharged white by hydrosulphite on cotton. The most important cotton black. Used largely for *leather*. Always united with Na_2CO_3.	
Chlorazol Black LF (BDC) Direct Black EL, RW, RE, RXX, 2R, (JWL) (SCC) (NCW)	A greyish-black powder. H_2O: blue-black solution. HCl: violet solution. NaOH: blue-black solution. H_2SO_4: violet-blue solution; violet solution on dilution. Dyes cotton and unions direct black.	

(NCC) (StD) **Cotton Black RW extra** (B) Naphthamine Direct Black RWK extra (K) Sodium salt of benzene-azo-3 : 6-disulpho-8-amino-1-naphthol-7-azo-diphenyl-azo-*m*-toluylene-diamine. No. 582 (463)	The fastness to washing is increased by after-treatment with formaldehyde; after-treatment with dichromate and copper sulphate converts the black into reddish-brown, fast to light and of moderately good fastness to washing. Light: 3–2. Used also in calico printing. Discharged white by hydrosulphite on cotton. In admixture with 583 the most used Direct Black, *Formic Black C* etc.	
Chlorazol Dark Green PL conc. (BDC) **Polyphenyl Green BD** (Gy) Sodium salt of benzene-azo-3 :6-disulpho-8-amino-1-naphthol-7-azo-diphenyl-azo-phenol. No. 583 (464)	*Erie Direct Green ET* (*Sch*)— A grey powder. H_2O: green solution. Alcohol: almost insoluble. HCl to aqueous solution: blue solution. NaOH: greenish-black solution. H_2SO_4: bluish-green solution; blue solution on dilution. Light: 2–3. Dyes cotton and unions direct blackish-green. Discharged white by hydrosulphite on cotton.	
Columbia Black-Green D (A) Sodium salt of benzene-azo-4-sulpho-1-amino-8-naphthol-7-azo-diphenyl-azo-salicylic acid. No. 584 (465)	Dyes cotton direct level black-green. Was used mainly for deepening shades; also in calico printing. Discharged white by hydrosulphite on cotton.	No longer manufactured.
Eboli Green B, CW, S, ST, T, (*L*) Sodium salt of *p*-sulphobenzene-azo-3:5-disulpho-1-amino-8-naphthol-7-azo-diphenyl-azo-salicylic acid. No. 585 (466)	*Eboli Green T*, greyish-black powder; ST black powder. In water: $\lambda = 665.5$ and 611.7. H_2O: green solution. HCl: green precipitate. NaOH: T, turbid solution; ST, soluble green precipitate. H_2SO_4: T, reddish-violet solution; ST, dark green solution; green precipitates on dilution. HNO_3: *id.* Dyes cotton direct green, rendered faster by after-treatment with	

	chromium fluoride or dichromate. Light: 4–3. Not manufactured.	
Diphenyl Green G (*Gy*) Sodium salt of *p*-nitro-*o*-chlorobenzene-azo-3:6-disulpho-1-amino-8-naphthol-7-azo-diphenyl-azo-phenol. No. 586 (467)	A black powder. H_2O: dark-green solution. $\lambda = 683.0$ changes to $\lambda = 679.0$. Alcohol: violet solution. HCl to aqueous solution: black precipitate. NaOH: dull green solution. H_2SO_4: violet solution, black precipitate on dilution. HNO_3: *id.* Dyes cotton direct green. Light: 4–3. Used also in calico printing. Discharged white by hydrosulphite on cotton.	
Diphenyl Green 3G (*Gy*) Sodium salt of *p*-nitro-*o*-chlorobenzene-azo-3:6-disulpho-1-amino-8-naphthol-7-azo-diphenyl-azo-salicylic acid. No. 587 (468)	A dark powder. In water: $\lambda = 677.0$ and [619.2]; changes to $\lambda = 675$: and (617.2). H_2O: green solution. Alcohol: sparingly soluble with a green colour. HCl to aqueous solution: green precipitate. NaOH: dull green solution and precipitate with excess. H_2SO_4: reddish-violet solution, green precipitate on dilution. HNO_3: *id.* Dyes cotton direct green. Light: 4–3.	
Chloramine Black N, (AAP) *Direct Black 2G* (NCW) Sodium salt of 2:5-dichlorobenzene-azo-3:6-disulpho-1-amino-8-naphthol-7-azo-diphenyl-azo-*m*-phenylenediamine. No. 588 (469)	*Chloramine Black N*— A dark bronzy powder. H_2O: dark bluish-green solution. HCl: blue precipitate. NaOH: bluish-green precipitate. H_2SO_4: blue solution, blue precipitate on dilution. Dyes cotton direct, unions and half-silk grey in light shades and greenish-black with 5–6% of colour. Light: 3–4. Used also in calico printing. Discharged white by hydrosulphite on cotton.	
Chloramine Green B (S) *Direct Green 2GB* (NCW) Sodium salt of 2:5-dichlorobenzene-azo-3:6-disulpho-1-amino-8-naphthol-7-azo-diphenyl-azo-phenol. No. 589 (470)	*Chloramine Green B*— A dark bronzy powder. In water: $\lambda = 610.2$ and 578.3. H_2O: green solution. Alcohol: green solution. HCl to aqueous solution: violet-black precipitate. NaOH: blackish-green solution. H_2SO_4: violet solution, violet-black precipitate on dilution. HNO_3: *id.* Dyes cotton direct bright green, fast to alkalies. Light: 3–4. Used also for dyeing uniform shades on unions and half-silk.	
Chloramine Blue 3G (S) *Polyphenyl Blue GN*[1] (Gy)	*Chloramine Blue 3G*— A dark bronzy powder. H_2O: blue solution. λ: points to mixture, but the dye is actually	

[1] G. N. Manufactured with o-chloro-aniline.

Sodium salt of 2:5-dichlorobenzene-azo-3:6-disulpho-1-amino-8-naphthol-7-azo-diphenyl-azo-8-amino-1-naphthol-3:6-disulphonic acid. No. 590 (471)	manufactured without admixture of other colours. HCl: blue solution. NaOH: blue solution. H_2SO_4: blue solution, violet-blue precipitate on dilution. HNO_3: *id.* Dyes cotton and silk direct greenish-blue from a neutral bath. Light: 3–4. Used also for dyeing half-silk; also in calico printing. Discharged white by hydrosulphite or stannous chloride on cotton.	
Chloramanil Blue HW (*AAP*) Sodium salt of 2:5-dichlorobenzene-azo-3:6-disulpho-1-amino-8-naphthol-7-azo-diphenyl-azo-7-amino-1-naphthol-3-sulphonic acid. No. 591 (472)	A dark bronzy powder. H_2O: blue solution. λ = 620 and 581.8. HCl: blue solution. NaOH: blue solution. H_2SO_4: blue solution, violet-blue precipitate on dilution. HNO_3: *id.* Dyes cotton direct blackish-blue from a neutral bath. Light: 4–3.	
Direct Fast Black GS HW, (PCC) (ICA) *Naphthamine Black H* (K) Sodium salt of *p*-nitrobenzene-azo-3:6-disulpho-1-amino-8-naphthol-7-azo-diphenyl-azo-7-amino-1-naphthol-3-sulphonic acid. No. 592 (473)	A blackish-grey powder. H_2O: black-blue solution. HCl: blue precipitate. NaOH: unaltered. H_2SO_4: blue solution, blue precipitate on dilution. Dyes cotton direct from a faintly alkaline salt bath greenish-black. Light: 3–4. *Melantherine HW* (SCI) is recommended for diazotisation on the fibre and development with β-naphthol. Used also in dyeing compound shades on cotton as a flattening agent; also in calico printing. Discharged white by hydrosulphite on cotton.	Little used.
Direct Green B, BL, FE, BN, (AJ) (CAC) (SCC) (CCC) (NCW) (S) (SCI) (LJ) (MC) (St-Cl) (StD) (VSt) (T) (L) (JDC) (ICA) (JWL) (S) (StD) Chlorazol Green BN (BDC) Diphenyl Green KGW (Gy)	A dark powder. In water: λ = 675.0 and 617.0. H_2O: dull green solution. Alcohol: bluish-green solution. HCl to aqueous solution: bluish-black precipitate. NaOH: yellower solution. H_2SO_4: violet solution, black precipitate on dilution. Zinc dust and acetic acid: decolorised, but a bright blue colour returns on air-oxidisation. HNO_3: blue. Dyes cotton direct green; soda should not be used in dyeing, as it tends to blacken the shade. Dyes wool, from an ammonium acetate bath, dark green, fast to milling, stoving, carbonising and of good fastness to light. Light: 3–4.	

Columbia Green B (A) Oxamine Green B (B) Naphthamine Green B (K) Sodium salt of *p*-nitrobenzene-azo-3:6-disulpho-1-amino-8-naphthol-7-azo-diphenyl-azo-phenol. No. 593 (474)	Used also for dyeing unions; also in calico printing. Discharged white by hydrosulphite on cotton. The first green substantive dye. **The most important direct green.**	
Direct Green G BG, J, (AJ), (SCC) (S) (ICA) (JDC) (JCO) (StCl) (VSt) Chlorazol Green G (BDC) Diphenyl Green GC (Gy) Triazol Green 2G (GrE) Naphthamine Green AN (K) Renol Green G extra (tM) Sodium salt of *o*-nitrobenzene-azo-3:6-disulpho-1-amino-8-naphthol-7-azo-diphenyl-azo-salicylic acid. No. 594 (475)	A black powder. In water: λ = 665.5 and 611.7. H_2O: dark green solution. Alcohol: bluish-green solution. HCl to aqueous solution: bluish-black precipitate. NaOH: yellower solution. H_2SO_4: violet solution, black precipitate on dilution. HNO_3: purple. Zinc dust and acetic acid: decolorised, but a blue colour returns on air-oxidation. Dyes cotton direct green from a neutral salt bath. It is sensitive to copper. Dyes wool and silk green from a faintly acid bath; and half-silk from a faintly alkaline bath. After-treatment with chromium fluoride renders the shade fast to milling. Used also in calico printing. Discharged white by hydrosulphite on cotton in the case of pale and medium shades. This dye is manufactured with ***o*-Nitroaniline** and not with *p*-Nitroaniline, as is always stated.	
Diazo Olive G (By) Sodium salt of *p*-aminobenzene-7-azo-4-sulpho-1-amino-8-naphthol-2-azo-diphenyl-azo-salicylic acid. No. 595	A black powder. H_2O: dark green solution. λ: points to a mixture. HCl: greenish-black precipitate. NaOH: greenish-black solution. H_2SO_4: violet solution, redder solution and then dark green precipitate on dilution. HNO_3: dark-green. Dyes cotton direct green, converted by diazotisation on the fibre and development with *m*-phenylenediamine or β-naphthol into olive-green, fast to washing, and of good fastness to acids in the latter case. Not sensitive to metals. Light: 4–3.	

	Used also in calico printing. Discharged white by hydrosulphite on cotton. The first green diazotisable dyestuff.	
Chlorazol Brown G (BDC) Diphenyl Brown G (Gy) Benzo Chrome Brown G (By) Dianil Chrome Brown G (MLB) Dianil Brown 3GN (MLB) Sodium salt of *p*-sulphobenzene-azo-*m*-phenylene-diamine-azo-di-phenyl-azo-salicylic acid. No. 596 (476) Brand G. S. is made with *m*-toluylene-diamine.	*Benzamine Brown* 3GO— A reddish-brown powder. H_2O: reddish-yellow solution. Alcohol: insoluble. HCl to aqueous solution: brown precipitate. NaOH: brownish-yellow solution. H_2SO_4: brownish-violet solution, brown precipitate on dilution. Sensitive to dilute acids. Dyes cotton direct brown from a faintly alkaline salt bath. Light: 4. The fastness to light and washing is increased by after-treatment with dichromate and copper sulphate. Used also for dyeing uniform shades on unions; also in calico printing. Discharged white by stannous chloride on cotton, or creamy-white by hydrosulphite in the case of pale shades.	The cheapest Brown on the market.
Diamineral Brown R (MLy) (C) **Dianil Chrome Brown R,** (MLB) Sodium salt of 4-sulpho-α-naphthalene-azo-*m*-phenylenediamine-azo-diphenyl-azo-salicylic acid. No. 597	*Cupranil Brown R*— A brownish-black powder. H_2O: dark orange-brown solution. HCl: dark brown precipitate. NaOH: redder solution and slight precipitate. H_2SO_4: violet solution, brown precipitate on dilution. Dyes cotton direct from a faintly alkaline salt bath brown, redder than No. 596, and only moderately fast to light and washing. The fastness to light and washing is increased by after-treatment with copper sulphate or dichromate and acetic acid, followed by soaping. Light: 3–4. Used for dyeing cotton and unions; also in machine dyeing; also in calico printing. Discharged white by hydrosulphite on cotton in the case of pale and medium shades.	A cheap Brown; fairly much used.
Congo Brown G (LDC) (Lev) (A) (RF) Direct Brown GXR GR, J, (NCW) (Sch) (StCl)	A brown powder. H_2O: red solution. Alcohol: brown solution. HCl to aqueous solution: brown precipitate. NaOH: red solution. H_2SO_4: reddish violet solution, dark reddish-brown precipitate on dilution.	

Diamine Brown 3G (C) Naphthamine Brown D3G, 4G, (K) Sodium salt of *p*-sulphobenzene-azo-resorcinol-azo-diphenyl-azo-salicylic acid. No. 598 (477)	Dyes cotton direct brown, rendered darker and faster to light and washing by after-treatment with copper sulphate (C below), or with a mixture of dichromate and copper sulphate. Light: 4–3. Dyes wool from a faintly acid bath brown, rendered fast to light, washing, milling and alkalies by after-treatment with copper sulphate or formaldehyde. Used also in calico printing. The direct shade is suitable for coloured discharges with hydrosulphite on cotton.	
Direct Green CO (LDC) (L) **Columbia Green** (A) Sodium salt of *p*-sulphobenzene-azo-4-sulpho-1-amino-8-naphthol-7-azo-diphenyl-azo-salicylic acid. No. 599 (478)	A black powder. In water: $\lambda = 650.7$ and 594.8. H_2O: green solution. Alcohol: insoluble. HCl to aqueous solution: dark green flocculent precipitate. NaOH: greenish-black solution. H_2SO_4: bluish-violet solution, green flocculent precipitate on dilution. Dyes cotton direct green. Light: 4–3. Used also in calico printing. Discharged white by hydrosulphite on cotton. Formerly much used, especially in France.	
Dianil Black R (*MLB*) Sodium salt of 4-sulpho-α-naphthalene-azo-3:6-disulpho-1:8-dihydroxynaphthalene-7-azo-diphenyl-azo-*m*-phenylene-diamine. No. 600 (479)	Small bronzy crystals. H_2O: sparingly soluble with a reddish-violet colour. Alcohol: insoluble. HCl to aqueous solution: violet precipitate. NaOH: bluer solution. H_2SO_4: dark blue solution; reddish-violet solution and precipitate on dilution. Dyes cotton direct black. After-treatment with diazotised *p*-nitroaniline renders the shade faster to washing. Light: 3–4. Used also in calico printing. Discharged white by hydrosulphite on cotton.	
Congo Brown R (Lev) (A) Sodium salt of 5-sulpho-α-naphthalene-azo-resorcinol-azo-diphenyl-azo-salicylic acid. No. 601 (480)	A dark brownish-red powder. H_2O: red solution. Alcohol: red solution. HCl to aqueous solution: brown precipitate. NaOH: red solution. H_2SO_4: violet solution, dark reddish-brown precipitate on dilution. Dyes cotton direct brown, rendered darker and faster to light and washing by after-treatment with copper sulphate or with a mixture of dichromate and copper sulphate. Light: 3–4. Used also in calico printing.	

	The direct shade is suitable for coloured discharges with hydrosulphite on cotton.	
Azo Corinth (*GrE*) Sodium salt of 4-sulpho-α-naphthalene-azo-resorcinol-azo-ditolyl-azo-2-amino-4-phenol-5-sulphonic acid. No. 602 (481)	A blackish-brown powder. H_2O: reddish-brown solution. Alcohol: insoluble. HCl to aqueous solution: reddish-brown precipitate. NaOH: bluish-red solution. H_2SO_4: bluish-violet solution, reddish-brown precipitate on dilution. Dyes cotton direct from a faintly alkaline soap bath maroon, moderately fast to washing, but not very fast to light, acids and alkalies. Light: 4. Used also for dyeing half-silk.	
Alizarine Yellow FS (DH) Diphenyl-tolyl-carbinol-trisazo-tri-salicylic acid. No. 603 (482)	A yellowish-brown paste. H_2O: insoluble. Alcohol: very sparingly soluble. HCl to aqueous solution: brown precipitate. NaOH: orange-yellow solution. H_2SO_4: green solution, brown precipitate on dilution. HNO_3: decomposed. Dyes chrome-mordanted wool yellow, moderately fast to light and milling. Used also in calico printing in conjunction with chromium acetate. Discharged pink by reducing agents as a result of the formation of Magenta.	No longer manufactured.
St Denis Direct Red (StD) *Trona Red 3B* (By) Rosanol 4B (K) Sodium salt of azo-toluene-disazo-bis-α-naphthol-4-sulphonic acid. No. 604 (483)	A red powder. H_2O: sparingly soluble with a red colour. $\lambda = 506.0$. Alcohol: sparingly soluble. HCl to aqueous solution: red precipitate. NaOH: soluble brick-red precipitate. H_2SO_4: red solution, red precipitate on dilution. HNO_3: *id.* Dyes cotton direct from a strongly caustic alkaline bath containing a large quantity of salt, brilliant scarlet, and wool from a bath in which a caustic alkaline solution of the dye is acidified carefully scarlet, fast to milling and scouring. Light: 3–4. Used also for dyeing mercerised cotton; also in calico printing. Discharged white by hydrosulphite on cotton.	
Acid Milling Scarlet (BSS) *Milling Scarlet B*, S, (CAC) Sodium salt of azoxy-toluene-azo-4-sulpho-α-naphthol-azo-β-naphthol-3:6-di-	A dark red powder. H_2O: scarlet solution. λ = about 490. Alcohol: insoluble. HCl to aqueous solution: unaltered. NaOH: orange-red solution. H_2SO_4: bluish-red solution, scarlet solution on dilution. HNO_3: *id.* Dyes wool from an acid bath scarlet-	

sulphonic acid No. 605 (484)	red, fast to milling and rubbing. Light: 3–4.	Scarcely used.
Benzo Brown G (*LDC*) (*Lev*) (*By*) *Congo Brown G* (MC) Sodium salt of benzene-*m*-disazo-bis-*m*-phenylenediamine-disazo-bis-benzene-4-sulphonic acid. No. 606 (485)	A brownish-black powder. H_2O: reddish-brown solution. Alcohol: partially soluble with a reddish-brown colour. HCl to aqueous solution: brown precipitate. NaOH: brown precipitate with a concentrated solution. H_2SO_4: violet-brown solution, violet solution and then brown precipitate on dilution. HNO_3: *id.* Dyes cotton from a neutral salt-bath yellowish-brown, moderately fast to washing, dilute acids and alkalies, but not fast to light. When developed on the fibre with diazotised *p*-nitroaniline, reddish-brown, much more intense and faster to washing than the direct dyeing, is obtained. Light: 3–4. Used also in calico printing. Discharged white by hydrosulphite on cotton in the case of both the direct and developed shades.	
Direct Brown J, JP, (*SCI*) Sodium salt of benzene-*m*-disazo-bis-*m*-phenylenediamine-disazo-bis-benzene-3-carboxylic acid. No. 607 (486)	A brown powder. H_2O: yellowish-brown solution. Alcohol: sparingly soluble. HCl to aqueous solution: dark brown precipitate. NaOH: unaltered. H_2SO_4: brown solution, brown precipitate on dilution. Dyes cotton direct brown. Light: 4–3.	
Benzo Brown B (LDC) (By) *Congo Brown M* (MC) Sodium salt of benzene-*m*-disazo-bis-*m*-phenylenediamine-dis-azo-bis-α-naphthalene-4-sulphonic acid. No. 608 (487)	A brownish-black powder. H_2O: reddish-brown solution. Alcohol: partially soluble with a reddish-brown colour. HCl to aqueous solution: brown precipitate. H_2SO_4: dull violet solution, brown precipitate on dilution. HNO_3: *id.* Dyes cotton direct from a neutral salt bath, brown rendered faster by diazotisation and development with β-naphthol. Light: 3–4. Used also in calico printing. Discharged white by hydrosulphite on cotton in the case of both the direct and developed shades.	
Toluylene Brown R (**By**) (**GrE**) Sodium salt of 4-sulpho-toluene-2:6-disazo-bis-*m*-phenylene-diamine-disazo-bis-α-naphthalene-4-sulphonic acid. No. 609 (488)	A black-brown powder. H_2O: brown solution. Alcohol: insoluble. HCl to aqueous solution: brown precipitate. NaOH: soluble brown precipitate. H_2SO_4: dull reddish-violet solution, brown precipitate on dilution. Dyes cotton direct from a soap bath brown, moderately fast to ironing,	

	washing, alkalies, and acids, but not fast to light. Light: 4–3.	A cheap dye.
Hessian Brown BB, BBN, O, (LDC) (L) Sodium salt of di-phenyl-disazo-bis-resorcinol-disazo-bis-benzene-4-sulphonic acid. No. 610 (489)	A black-brown powder. H_2O: brown solution. Alcohol: sparingly soluble. HCl to aqueous solution: brown precipitate. NaOH: deep red solution. H_2SO_4: violet-black solution, brown precipitate on dilution. Dyes cotton direct brown. Light: 3–4. Used also for dyeing unions and half-silk.	
Hessian Brown MM (LDC) (L) Sodium salt of ditolyl-disazo-bis-resorcinol-disazo-bis-benzene-4-sulphonic acid. No. 611	A brown powder. H_2O: brown solution. Alcohol: sparingly soluble. HCl to aqueous solution: brown precipitate. NaOH: reddish-brown solution. H_2SO_4: violet-black solution, brown precipitate on dilution. Dyes cotton direct from a faintly alkaline Glauber's salt bath brown, fast to acids and alkalies and moderately fast to washing and light. The fastness to light is increased by after-treatment with copper sulphate. Light: 3–4.	
Benzo Brown BR, BX' (By) *Cotton Brown A, N* (C) Sodium salt of di-phenyl-disazo-bis-*m*-phenylenediamine-disazo-bis-α-naphthalene-4-sulphonic acid. No. 612 (490)	*Cotton Brown A*, A dark green powder; Cotton Brown N, A dark brown powder. H_2O: reddish-brown solution. HCl: brown precipitate. NaOH: unaltered. H_2SO_4: reddish-violet solution, brown precipitate on dilution. Dyes cotton direct from a neutral salt bath chestnut-brown of low fastness; brown shades, fast to washing, are obtained by development with diazotised *p*-nitroaniline, or by diazotisation on the fibre and development with β-naphthol. Light: 3–4. Used also in calico printing. Discharged white by hydrosulphite in presence of leucotrope on cotton in the case of both the direct and developed shades.	
Direct Heliotrope B (R) Sodium salt of di-phenyl-azo-4-sulpho-α-naphthol-3-azo-toluene-4:6-disazo-bis-α-naphthol-4-sulphonic acid. No. 613 Constitution not certain.	A bronzy powder. H_2O: violet solution. Alcohol: sparingly soluble. HCl to aqueous solution: reddish-violet precipitate. NaOH: rather bluer solution. H_2SO_4: blue solution, reddish-violet precipitate on dilution. Dyes cotton direct from a bath containing 10% sodium phosphate, 5% soap and 5% common salt pure violet. Light: 3–4.	

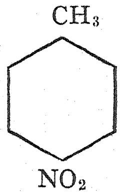
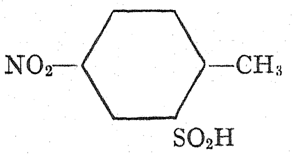
Mekong Yellow G (DH) Sodium salt of bis-diphenyl-disazo-dihydroxy-diphenylmethane-disazo-bis-salicylic acid. No. 614	A yellowish-brown powder. H_2O: yellowish-brown solution. HCl: brown precipitate. NaOH: reddish-brown solution. H_2SO_4: violet solution, brown precipitate on dilution. Dyes cotton direct greenish-yellow from a soap bath. Light: 4–5.	No longer manufactured.
Mekong Yellow R (DH) Sodium salt of bis-ditolyl-disazo-dihydroxy-diphenylmethane-disazo-bis-salicylic acid. No. 615	A dark brown powder. H_2O: yellowish-brown solution. HCl: dark brown precipitate. NaOH: redder solution. H_2SO_4: bluish-violet solution, blackish-brown precipitate on dilution. Dyes cotton direct yellow. Light: 4–3.	No longer manufactured.
Azo Orange R (*DH*) Sodium salt of bis-ditolyl-disazo-dihydroxy-diphenylmethane-disazo-bis-α-naphthylamine-4-sulphonic acid. No. 616	A brick-red powder. H_2O: brownish-yellow solution. HCl: dark grey precipitate. NaOH: redder solution. H_2SO_4: blue solution, dark grey precipitate on dilution. Dyes cotton direct orange. Light: 4–3.	No longer manufactured.
Dianil Black PR (*MLB*) Sodium salt of *o*-sulpho-diphenyl-disazo-bis-(3-sulpho-1-naphthol-7-azo-*m*-phenylenediamine). No. 617 (491)	A black powder. H_2O: soluble. Alcohol: insoluble. HCl to aqueous solution: blue precipitate. NaOH: precipitate. H_2SO_4: dark blue solution, blue precipitate on dilution. HNO_3: blue. Dyes cotton direct black from an alkaline bath. The fastness is increased by development with diazotised *p*-nitroaniline (N. below). Light: 4–5. Used also in calico printing. Discharged white by hydrosulphite on cotton.	Scarcely used.
Anthracene Acid Brown B (C) Sodium salt of bis-(salicylic-acid-azo-6 or 7-sulpho-a-naphthalene-azo)-*m*-phenylenediamine. No. 618 (492)	A blackish-brown powder. H_2O: brown solution. HCl: violet solution and precipitate. NaOH: unaltered. H_2SO_4: greyish-violet solution; violet solution and then violet precipitate on dilution. Dyes wool from an acid bath and afterchromed, or chrome-mordanted wool, dark brown of good fastness to light, stoving, dry-steaming and carbonising in the former case. Light: 2–3.	

Naphthamine Fast Black RS, (*K*) Sodium salt of 3:6-disulpho-1-amino-8-naphthol-2:7-dis-azo-bis-(benzene-azo-*m*-phenylenediamine). No. 619	A black powder. H_2O: dull greenish-black solution. HCl: violet-red precipitate. NaOH: dull bluish-green solution. H_2SO_4: dark greenish-blue solution; violet solution and then brownish-black precipitate on dilution. HNO_3: *id.* Dyes cotton direct black. Scarcely used. Light: 3.

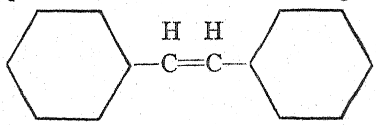
III. STILBENE COLOURING MATTERS

No. 620–635

The Stilbene Colouring Matters are all manufactured from *p*-nitrotoluene and its derivatives:

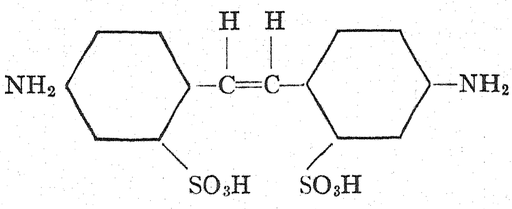
p-Nitrotoluene   *p*-Nitrotoluene-*m*-sulphonic acid.

These are condensed with sodium hydroxide in aqueous solution, giving rise to complicated derivatives containing the stilbene-group:

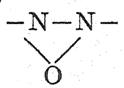


Stilbene

A. Green and his collaborators have studied the reaction very carefully and have given several formulae to represent the constitution of these compounds, but, in the opinion of the writer, none of these can be regarded as satisfactory, because, on reduction of the Stilbene colouring matters, there is always obtained diamino-stilbene-disulphonic acid, together with many other products which have not been identified completely.



p.p'-Diamido-*m.m'*-Disulphonic Acid

Besides the stilbene group, the Stilbene dyes contain very probably an azoxy-group: , or a nitroso-group: $-N{=}O$, and also an azo group: $-N{=}N-$, but it is not possible

to give an exact formula for any of these important compounds. These dyes are only completely reduced by strong reducing agents, such as zinc dust and alkali or ammonium sulphide on boiling, whilst tin and hydrochloric acid fail to decompose them completely. For this reason the Stilbene colouring matters are reduced by weak or fairly strong reducing agents, giving leuco compounds which are reoxidised on exposure to air, and in this respect they resemble the Azines, Oxazines, Indigoids, Vat dyes in general, Carbonium dyes, such as Triphenylmethane dyes, Pyronines and also Acridines. As practically only the Acridines and Auramine are also yellow but do not dye cotton without mordant, the differentiation is not difficult. Many of the Stilbene dyestuffs give, with concentrated hydrochloric acid, a blue or violet-red coloration which disappears on diluting with much water, but this reaction is not very reliable. The best means of detection is the reduction with zinc dust and caustic soda on boiling, when a considerable quantity of diaminostilbene-di-sulphonic acid will always be formed, and this is readily precipitated from the filtered solution with mineral acid, being practically insoluble in water, hot or cold. On diazotising (tetrazotising) this acid with hydrochloric acid and sodium nitrite and mixing the tetrazo solution with a solution of phenol in dilute sodium carbonate and ice there is formed *Brilliant Yellow* (see No. 364), which gives the characteristic reactions described under this heading. (HCl conc., bluish-violet; NaOH, red-orange; acetic acid, bright yellow.) This test is very distinctive.

Many of these Stilbene dystuffs contain an azo group, because the dyestuff which has been formed first has been diazotised again. They are, therefore, Stilbene-azo-dyestuffs. These behave like the simple Stilbene dyestuffs (Sun Yellow, for instance), giving diamino stilbene-di-sulphonic acid on strong reduction. All Stilbene colouring matters dye cotton from alkaline bath, but *leave wool or silk uncoloured.* This property is *the most characteristic* of this class and renders it very useful in piece-goods dyeing.

Chlorazol Yellow GX (BDC) Direct Yellow R RT, (CAC) (StD) (By)	A reddish-brown powder. In water partial absorption in blue and violet. H_2O: reddish-yellow solution. Alcohol: insoluble. HCl to aqueous solution: brownish-yellow precipitate. NaOH: reddish-yellow precipitate. H_2SO_4: *Sun Yellow,* reddish-violet	

(GrE) (CAC) Direct Yellow F, G, T, J, (CD) (Sch) (NCW) (SCI) (T) (ICA) (K) (SCI) (StD) Sun Yellow 3GC, G, GG, R, (Gy) (Gy) (S) Diamine Fast Yellow A, AR (MLy) (C) Stilbene Yellow extra (StCl) Naphthamine Yellow G (K) Sodium salt of azoxy-azo-distilbene-tetra-sulphonic acid. No. 620 (9)	solution; *Curcumine S* and *Naphthamine Yellow G*, cherry-red solutions; yellow solutions and then brownish-yellow precipitates on dilution. Zinc dust and NaOH: diaminostilbene disulphonic acid. Dyes cotton direct from a salt bath, or wool and silk from an acid bath, golden-yellow. When unions or half-silk are dyed from a neutral bath, only the cotton is dyed. Not discharged white by hydrosulphite on cotton. A very important dye.	
Chlorazol Fast Orange D (BDC) Stilbene Orange 4R, G extra, (CAC) (StCl) Direct Fast Orange RL, 2RL, G (JWL) (CCC) Direct Orange 2R, 2RG, G, (NCW) (Gy) Mikado Orange G, R, 2R, 3R, 3RO, 4R, 4RO, 5R, 5RO, 3R, (MC) (A) (By) (L) (T) Stilbene Yellow 3G (B) Chloramine Orange G	Orange to brown powders. In water: partial absorption in blue and violet. H_2O: orange to brown solutions. Alcohol: insoluble. HCl to aqueous solution: brown precipitate. NaOH: yellow to orange precipitate. H_2SO_4: red to violet-black solutions, brown precipitate on dilution. HNO_3: black. Dyes cotton direct from a salt bath yellowish-orange to brown. Light: 2–3. Unsuitable for discharge work in calico printing.	

(By) Naphthamine Orange 2R (K) Sodium salt of dis-azo-distilbene tetrasulphonic acid. No. 621 (11)		
Chlorazol Fast Yellow EG (BDC) Stilbene Yellow 2G, 3G, 4G, 8G, G, 3GP, (CAC) (B) Formal Yellow (Gy) Polyphenyl Yellow 3G (Gy) Mikado Gold Yellow 2G, 4G, 6G, 8G, (MC) (L) (MC) (L) (A) Mikado Yellow G, G extra, (A) (MC) (L) Naphthamine Yellow 2G, 3G, (K) Dianil Direct Yellow S (MLB) Renol Yellow G (tM) Sodium salt of dinitro-azo-distilbene-tetrasulphonic acid.	An orange-yellow powder. In water: partial absorption in blue and violet. H_2O: yellow solution. Alcohol: insoluble. HCl to aqueous solution: yellow precipitate, soluble in water. NaOH: yellow precipitate, soluble in water. H_2SO_4: red to orange solutions, yellow to yellowish-brown solution on dilution. Dyes cotton direct from a salt bath greenish-yellow. Used mainly for dyeing unions and half-silk; also for dyeing jute and linen. Light: 2–3. Unsuitable for discharge work in calico printing. Important for leather.	
No. 622 (10) **Mikado Brown B,** BB, G, 3GO, M, (MC) (L) **Direct Brown G** (T)	A dark brown powder. H_2O: brown solution. Alcohol: insoluble. HCl to aqueous solution: brown precipitate. NaOH: unaltered. H_2SO_4: violet-black solu-	

Sodium salt of disazo-distilbene-tetrasulphonic acid (No. 621), together with a considerable proportion of azo-methine by-products. No. 623	tion, brown precipitate on dilution. HNO_3: black-brown. Dyes cotton direct brown, moderately fast to washing, acids, and alkalies, but of low fastness to light, and not fast to chlorine. Light: 3. Used also for dyeing unions and half-silk. Unsuitable for discharge work in calico printing.	
Cotton Yellow 6307 (Br) **Diphenyl Citronine G** (Gy) Sodium salt of dinitro-azo-distilbene-tetrasulphonic acid (No. 622), with the sodium salt of disulpho-stilbene-disazo-bis-benzene. No. 624 (12)	A yellow powder. H_2O: pure yellow solution. Alcohol: sparingly soluble with a yellow colour. HCl to aqueous solution: brownish-yellow precipitate. NaOH: orange-yellow precipitate. H_2SO_4: reddish-orange solution, yellowish-brown precipitate on dilution. HNO_3: red. Dyes cotton direct greenish-yellow, fast to alkalies, washing, acids and light. Light: 3–2. Used for dyeing cotton, unions and half-silk; cotton is dyed more deeply than wool or silk.	
Cotton Orange 6305 (Br) *Cotton Brown R* (Gy) *Direct Brown R* (Gy) *Fast Cotton Brown R* (Gy) *Polychromine B* (Gy) Sodium salt of disulpho-stilbene-disazo-bis-*p*-amino-benzene. No. 625 (13)	A reddish-brown powder. H_2O: orange-brown solution. HCl: blue-black precipitate. NaOH: unaltered. H_2SO_4: reddish-violet solution, bluish-black precipitate on dilution. HNO_3: black. Dyes cotton direct from a neutral or alkaline bath orange-brown, moderately fast to light and washing, darkened by acids, but not sensitive to alkalies. When diazotised on the fibre and developed with β-naphthol Bordeaux red is obtained, with resorcinol or *m*-phenylenediamine brown, and with naphthylamine black. Not used as a pure dye.	
Diphenyl Orange RR *(Gy)* Sodium salts of azoxy-azo-distilbene tetrasulphonic acid (No. 620) and disulpho-stilbene-disazo-bis-*p*-amino-benzene. (No. 625) No. 626	A light brown powder. H_2O: orange-yellow solution. HCl: bluish-black precipitate. NaOH: orange precipitate. H_2SO_4: cherry-red solution, bluish-black precipitate on dilution. Dyes cotton direct reddish-orange, moderately fast to light, washing and alkalies, but dulled by acids. When diazotised on the fibre and developed with β-naphthol or *m*-toluylenediamine claret-red and reddish-brown respectively are obtained. Light: 3–2.	
Diphenyl Chrysoine RR *(Gy)*	A reddish-brown powder. H_2O: reddish-orange solution.	

Components— Diphenyl Orange (No. 626) Phenol and Ethylate. No. 627 (205)	Alcohol: very sparingly soluble. HCl to aqueous solution: blackish-brown precipitate. NaOH: reddish-brown precipitate. H_2SO_4: pure blue solution, brownish-black precipitate on dilution. HNO_3: blue. Dyes cotton direct reddish-orange. Light: 2.
Diphenyl Catechine G (Gy) Components— Diphenyl Orange RR (No. 626) Dimethyl-amino-naphthol, sulphonic acid γ (alk). No. 628 (206)	A dark brown powder. H_2O: yellowish-brown solution. Alcohol: insoluble. HCl to aqueous solution: dark brown precipitate. NaOH: brown precipitate. H_2SO_4: violet-black solution, dark brown precipitate on dilution. Dyes cotton direct cutch-brown. Light: 2. Very sensitive to acids. Used also in calico printing. Discharged white by hydrosulphite on cotton. In alkaline bath only cotton fibre is dyed.
Diphenyl Fast Brown G (Gy) Components— Sun Yellow condensed with *p*-phenylenediamine and heated to dryness with NaOH. Constitution given in Colour Index is not correct. It is unknown. No. 629 (207)	A dark brown powder. H_2O: dark yellowish-brown solution. Alcohol: insoluble. HCl to aqueous solution: blackish-brown precipitate. NaOH: dark brown precipitate. H_2SO_4: dark blue solution, blackish-brown precipitate on dilution. Dyes cotton direct dark yellowish-brown. Light: 2–3.
Arnica Yellow (Gy) Sodium salt of disulphostilbene-disazo-bis-phenol. No. 630	A brown powder. H_2O: brownish-yellow solution. HCl: brownish-black precipitate. NaOH: unaltered. H_2SO_4: violet solution, dark brown precipitate on dilution. Dyes cotton direct from a salt bath golden-yellow, moderately fast to light and washing, of good fastness to dilute acids, but reddened by alkalies. Not used, except to a small extent for paper. Light: 1–2 on paper.
Diphenyl Chrysine G (Gy) Constitution uncertain. No. 631 (14) Quite different from	A yellowish-brown powder. H_2O: golden-yellow solution. Alcohol: yellow solution. HCl to aqueous solution: black-brown precipitate. NaOH: orange precipitate. H_2SO_4: violet-red solution, black-brown precipitate on dilution. HNO_3: brown. Dyes cotton direct golden-yellow. Especially used for under-wear.

Chrysophenine (Cf. Colour Index, where statement is wrong).	Leaves wool and silk white in alkaline bath. Light: 2–1.	
Diphenyl Fast Yellow (Gy) Sodium salt of dinitro-azo-distilbene-tetra-sulphonic acid (No. 622) with the sodium salt of disulpho-stilbene-disazo-bis-sulpho-benzenyl-amino-thio-cresol. No. 632 (18)	A yellow powder. H_2O: yellow solution. Alcohol: sparingly soluble. HCl to aqueous solution: brownish-orange precipitate. NaOH: orange-yellow precipitate. H_2SO_4: red solution, brownish-yellow precipitate on dilution. Dyes cotton direct from a Glauber's salt bath yellow fast to light, washing, acids and alkalies. Light: 2–3. Used also for dyeing silk, unions and half-silk.	
Chicago Orange G (*AAP*) (*Gy*) Sodium salt of disulpho-stilbene-disazo-bis-*p*-amino-diphenyl. No. 633 (15)	A brown powder. H_2O: orange-yellow solution. Alcohol: insoluble. HCl to aqueous solution: brown precipitate. $C_2H_4O_2$: brown precipitate. NaOH: orange-brown precipitate. H_2SO_4: violet solution, brown precipitate on dilution. Dyes cotton and linen direct from a boiling neutral salt bath reddish-orange, rendered faster to washing and light by after-treatment with copper sulphate. Light: 3–2.	Very little in use.
Curcuphenine (CAC) *Curcuphenine Yellow* (CAC) Sodium salt of the hexasulphonic acid of the dehydro-thio-*p*-toluidide of azoxy-stilbene-aldehyde. No. 634 (16)	An orange-yellow powder. H_2O: yellow solution. Alcohol: insoluble. HCl to aqueous solution: brown precipitate. NaOH: no precipitate. H_2SO_4: red solution, brownish-yellow precipitate on dilution. HNO_3: brown. Dyes cotton, linen and jute direct from a salt bath, to which some soda is added, orange-yellow of excellent fastness to alkalies and washing; wool and silk are dyed from an acid bath. Light: 3–4.	Little used.
Chlorophenine Orange GO, R, RO, RR, Y (CAC) *Chlorophenine Orange* (SCI) Sodium salt of the hexa-sulphonic acid of the dehydrothio-*p*-toluidide of azo-stilbene-aldehyde. No. 635 (17)	An orange-red powder. H_2O: orange-yellow solution. HCl: dark precipitate. NaOH: unaltered. H_2SO_4: blue solution, dark precipitate on dilution. HNO_3: blue-black. Dyes cotton direct bright orange of good fastness to washing and alkalies. Light: 3–4.	Very little used.

PYRAZOLONE-DYES
NO. 636–653

Fast Light Yellow G, 2G, 3G, (AJ) (JBS) (By) (LBH) (GCC) (By) **Flavazine NL,** L, (CN) (MLB) Hydrazine Yellow L (GrE) Fast Wool Yellow GL, 2GL, 3GL, (K) Sodium salt of 4-benzene-azo-1-*p*-sulphobenzene-3-methyl-5-hydroxy-pyrazol. No. 636 (19)	A yellow powder; the free acid separates from dilute acetic acid in brownish-yellow crystals, M. P. 262°. H_2O: yellow solution. Alcohol: greenish-yellow solution. HCl to aqueous solution: turbid solution. Fuming HCl: the free acid separates as an oil which sets to a crystalline mass, M. P. 262°. NaOH: lighter solution. H_2SO_4: reddish-yellow solution, precipitate on dilution, soluble in water. Dyes wool and silk clear yellow from an acid bath. Level-dyeing 2; relation to cotton, 1–2; relation to silk, 3. Used also for the manufacture of lakes of good fastness to light and spirit and moderate fastness to water. Light: 2–1. Discharged white by hydrosulphite. Important acid yellow.	
Kiton Yellow S, SR, (CAC) (SCI) **Xylene Yellow S** (S) **Flavazine NS,** S, (CN) (MLB) **Hydrazine Yellow S** (GrE) **Fast Wool Yellow G** (K) Sodium salt of 4-benzene-azo-1-*p*-sulphophenyl-5-hydroxy-pyrazol-3-carboxylic acid. No. 637 (20)	An orange-yellow powder. H_2O: dark yellow solution. HCl: turbid solution and brownish-yellow precipitate. NaOH: lighter solution. H_2SO_4: brownish-yellow solution, redder solution and then brownish-yellow precipitate on dilution. Dyes wool from an acid bath yellow, more level than Tartrazine (No. 640). Level-dyeing 2; relation to cotton, 1–2; relation to silk, 3. Light: 2. Used in conjuction with other dyes for dyeing green and brown on yarn, for dyeing hats and piece goods, for shading after-chromed colours, and for the manufacture of pigments.	
Pigment Chrome Yellow L Paste **(MLB)** 4-*o*-Toluene-azo-1-phenyl-3-methyl-5-hydroxy-pyrazol. No. 638 (21)	An orange-yellow paste. H_2O: insoluble. Alcohol: orange-yellow solution. HCl to paste: unaltered. NaOH: unaltered. H_2SO_4: orange solution, orange-yellow precipitate on dilution. Used with substrata for the manufacture of orange-yellow lakes which are employed as non-poisonous substitutes for Chrome Yellow, particularly in wallpapers. The lake possesses excellent fastness to light and oil, and is of good fastness to water and lime. Light: 1–2.	

Xylene Light Yellow 2G, 3GS, R, (CAC) (S) (S) **Xylene Yellow 3G** (S) **Supra Light Yellow GL** (By) Sodium salt of 2-sulphobenzene-4-methyl-azo-1-*o*-*m*-dichloro-*p*-sulphophenyl-3-methyl-5-hydroxy-pyrazol. No. 639 (22)	A bright yellow powder. H_2O: readily soluble with a greenish-yellow colour. Alcohol: very sparingly soluble, with a greenish-yellow colour. HCl to aqueous solution: unaltered. NaOH: *Xylene Yellow* 3G, reddish-yellow solution; *Xylene Light Yellow* 2G, scarcely altered. H_2SO_4: greenish-yellow solution, unaltered on dilution. Zinc dust: the solution is decolorised, but the 1-*o*-*m*-dichloro-*p*-sulphophenyl-3-methyl-4-amino-5-pyrazolone formed produces a red-violet colour when the solution is reoxidised by air. Dyes wool from an acid bath greenish-yellow, fast to light. *Xylene Light Yellow* R dyes wool from a neutral bath yellow of good fastness to light and perspiration. Used also for the manufacture of lakes.
Tartrazine certified, N, Yellow, I, O (AJ) (H) (CCC) (B) (By) (NAC) (CN) (StD) (ICA) (MLB) Acid Yellow 79210 AT, (BDC) (MLy) (C) Hydrazine Yellow O (GrE) Fast Wool Yellow GT (K) Flavazine T (MLB) Sodium salt of 4-*p*-sulphobenzene-azo-1-*p*-sulphophenyl-5-hydroxy-pyrazol-3-carboxylic acid. No. 640 (23)	An orange-yellow powder. In water: partial absorption in blue and violet. H_2O: golden-yellow solution. HCl: unaltered. NaOH: redder solution. H_2SO_4: orange-yellow solution; yellow solution on dilution. Dyes wool and silk level bright yellow from an acid bath. The shades on wool are moderately fast to light, 2–3 milling, acids, alkalies and stoving, but the shades on silk possess remarkably low fastness. Used largely for dyeing wool; also for colouring foodstuffs; also in photography for light filters and for self-screened orthochromatic plates. Tartrazine is reduced readily by titanous chloride.
Pigment Fast Yellow R **(MLB)** Sodium salt of 4-*p*-sulpho-*o*-toluene-azo-1-phenyl-3-methyl-5-	A yellow powder. H_2O: sparingly soluble cold, readily soluble hot, with a yellow colour. HCl: yellow precipitate. NaOH: not altered appreciably. H_2SO_4: yellow

hydroxy-pyrazol. No. 641 (24)	solution, pale yellow flocculent precipitate on dilution. Used, when precipitated by barium chloride on a substratum, for the manufacture of yellow lakes for book and lithographic printing, wallpapers and marbled papers. The shades are redder and less fast to light than Pigment Fast Yellow G (No. 651), but are of good fastness to alkalies, spirit and water. Light: 2.	
Polar Yellow 5G conc. (GY) Sodium salt of the toluene-*p*-sulphonyl-ether- of 4-*p*-hydroxy-benzene-azo-1-*p*-chloro-*o*-sulpho-phenyl-3-methyl-5-hydroxy-pyrazol. No. 642	A brownish-yellow powder. H_2O: pure yellow solution. Alcohol: yellow solution. HCl to aqueous solution: yellowish-brown precipitate. NaOH: unaltered. H_2SO_4: yellow solution, yellow precipitate on dilution. HNO_3: yellow brown. Dyes wool from an acid bath, or from a neutral bath, yellow, fast to light, milling and alkalies. Light: 1–2.	
Radial Yellow G, 3G (B) Sodium salt of 4-*o*-chloro-*p*-sulpho-*o*-toluene-azo-1-*p*-sulpho-*o*-chloro-*o*-toluene-5-hydroxy-pyrazol-3-carboxylic acid. No. 643 (30)	G, orange-yellow powder; 3G, yellow powder. H_2O: yellow solution. Alcohol: partially soluble hot. HCl to aqueous solution: unaltered. NaOH: orange-yellow solution. H_2SO_4: yellow solution, unaltered on dilution. Used for the manufacture of greenish-yellow lakes of good fastness to light, particularly fast to oil and spirit, and moderately fast to water. Light: 2.	
Normal Yellow 3GL (MLB) Sodium salt of 4-*o*-sulpho-*m*-xylene-azo-1-*p*-sulpho-phenyl-5-hydroxy-pyrazol-3-carboxylic acid. No. 644	*Normal Yellow* 5GL— A yellow powder. H_2O: yellow solution. Alcohol: partially soluble with a yellow colour. HCl to aqueous solution: unaltered. NaOH: rather darker solution. H_2SO_4: orange solution; yellow solution on dilution. Dyes wool from an acid bath, greenish-yellow, greener and faster to light than Tartrazine (No. 640). Light: 2–1. Used for dyeing wool and particularly for the manufacture of lakes of good fastness to light as substitutes for Chrome Yellow.	
Kiton Fast Yellow 3G R, (SCI) No. 645 Made from Pyrazolones obtained from chloro-anilines and coupled with *p*-toluidine-*o*-sulphonic	*Kiton Fast Yellow* 3G— A yellow powder. H_2O: yellow solution. Alcohol: yellow solution. HCl to aqueous solution: unaltered. NaOH: unaltered. H_2SO_4: yellow solution, yellow precipitate on dilution. HNO_3: *id.*	

acids; also **Erioflavin R.**	Dyes wool from an acid bath yellow of good fastness to light and washing but not fast to milling. *Kiton Fast Yellow R* dyes wool from a neutral bath orange of good fastness to light, washing and milling. Light: 2–1.	
Dianil Orange G (*MLB*) Sodium salt of 4-Primuline-azo-1-*p*-sulpho-phenyl-5-hydroxy-pyrazol-3-carboxylic acid. No. 646	An orange-red powder. H_2O: orange-yellow solution. HCl: orange solution. NaOH: redder solution. H_2SO_4: reddish-yellow solution; orange solution on dilution. HNO_3: *id.* Dyes cotton direct clear orange, moderately fast to light and washing, of good fastness to alkalies and acids, and rendered faster to washing by after-treatment with copper salts. Light: 3–4. Used also for dyeing unions and half-silk, the cotton being dyed more deeply than the wool or silk. A satisfactory white discharge cannot be obtained in calico printing by the use of the usual reagents.	
Dianil Yellow 3G (*MLB*) Sodium salt of Primuline-azo-acetoacetic-ether. No. 647 (25)	A yellow powder. H_2O: yellow solution. HCl: yellow precipitate. NaOH: brown precipitate. H_2SO_4: brown solution, yellow precipitate on dilution. HNO_3: *id.* Dyes cotton direct yellow, rendered faster by after-treatment with copper sulphate. Light: 3–4. A satisfactory white discharge cannot be obtained in calico printing by the use of the usual reagents.	
Dianil Yellow 3GN' (*MLB*) Sodium salt of Primuline-azo-acetoacetic-anilide. No. 648	A yellowish-brown powder. H_2O: yellow solution. HCl: yellowish-brown precipitate. NaOH: yellowish-brown solution and precipitate. H_2SO_4: yellowish-brown solution, brownish-yellow precipitate on dilution. HNO_3: *id.* Dyes cotton direct yellow, rendered faster by after-treatment with dichromate or copper sulphate. Light: 4–3. A satisfactory white discharge cannot be obtained in calico printing by the use of the usual reagents.	
Dianil Yellow R (MLB) Sodium salt of 4-Primuline-azo-1-phenyl-3-methyl-5-hydroxy-pyrazol. No. 649 (26)	A yellowish-brown powder. H_2O: yellow solution. HCl: orange-yellow precipitate. NaOH: slightly darker solution. H_2SO_4: yellow solution, orange-yellow precipitate on dilution. Dyes cotton direct from a salt bath golden-yellow, moderately fast to	

	light and of good fastness to alkalies; rendered faster by after-treatment with dichromate or copper sulphate. Light: 4–3. Used also for dyeing silk and unions, and for the manufacture of pigments. A satisfactory white discharge cannot be obtained in calico printing by the use of the usual reagents.	
Dianil Yellow 2R (*MLB*) Sodium salt of 4-Primuline-azo-1-*p*-sulpho-phenyl-3-methyl-5-hydroxy-pyrazolone. No. 650 (27)	An orange-yellow powder. H_2O: reddish-yellow solution. HCl: orange-yellow flocculent precipitate. NaOH: darker solution. H_2SO_4: yellow solution, orange-yellow precipitate on dilution. HNO_3: orange. Dyes cotton direct clear yellow of good fastness to alkalies and moderate fastness to light; rendered faster by after-treatment with dichromate or copper sulphate. Used also for dyeing silk and unions; and for the manufacture of pigments. Light: 3–4. A satisfactory white discharge cannot be obtained in calico printing by the use of the usual reagents.	
Pigment Fast Yellow G (*MLB*) Sodium salt of 4-*m*-sulpho-*o*-benzoic-acid-azo-1-phenly-3-methyl-5-hydroxy-pyrazol. No. 651 (28)	A yellow powder. H_2O: sparingly soluble cold, readily soluble hot, with a yellow colour. HCl: yellow precipitate, soluble in excess. NaOH: unaltered. H_2SO_4: yellow solution, light yellow precipitate on dilution. HNO_3: yellow. Used for the manufacture of yellow lakes, particularly for colouring paper. The golden-yellow baryta lake is in full shades almost as fast to light as the Alizarine lake, but in pale shades it is only about one-quarter as fast; of good fastness to alkalies, spirit and water. Light: 2.	
Eriochrome Red B (Gy) Omega Chrome Red B (S) Salicine Bordeaux R (K) Sodium salt of 4-*p*-sulpho-β-naphthol-α-azo-1-phenyl-3-methyl-5-hydroxy-	A brownish-red powder. H_2O: soluble hot with a yellowish-red colour. HCl: vivid scarlet-red precipitate. NaOH: orange-yellow solution. H_2SO_4: magenta-red solution, scarlet-red precipitate on dilution. HNO_3: orange. Dyes wool from an acid bath level reddish-brown-yellow, converted by after-chroming into crimson-red, or wool from a single bath with metachrome mordant; fuller and deeper shades are obtained when dyed on chrome-mordanted wool from an acid bath.	

pyrazol. No. 652 (29) Will be on the market as Pigment Scarlet 3B	Level-dyeing 2; relation to cotton 1–2; relation to silk 4. Light: 2–1. Used also for bottoming Indigo as it gives a good Indigo spot with nitric acid. **The best Chrome-Red on the market.**	
Pryazol Orange G, R, RR, (*S*) Sodium salt of diphenyl-azo-salicylic-acid-azo-1-*p*-sulphophenyl-5-hydroxy-pyrazol-3-carboxylic acid. No. 653	*Pyrazol Orange G*— A reddish-brown powder. H_2O: orange solution. HCl: orange-brown flocculent precipitate. NaOH: darker and redder solution. H_2SO_4: violet-red solution, brown precipitate on dilution. Dyes cotton direct from a neutral or faintly alkaline salt bath orange, of medium fastness to light. Light: 3. Used particularly for dyeing unions; also in calico printing. Discharged white by hydrosulphite on cotton.	
Diazo Fast Yellow 2G (By) **Diazo Light Yellow 2G** (By) Sodium salt of *p*-*p*-diamino-dibenzoyl-*p*-*p*-diaminodiphenyl-urea-*m*-*m*-disulphonic acid. No. 654	A light greyish-white powder. H_2O: almost colourless solution. HCl: yellowish-white flocculent precipitate. NaOH: faint precipitate. H_2SO_4: almost colourless solution, yellowish-white precipitate on dilution. HNO_3: decomposition. Dyes cotton direct from an alkaline bath white, converted into clear yellow, fast to acids, light and washing and not sensitive to metals, by diazotisation on the fibre and development with 1-phenyl-3-methyl-5-pyrazolone (Developer Z). Light: 2–1. Used also in calico printing. Discharged white by hydrosulphite in presence of leucotrope on cotton. Practically colourless; only, on developing, yellow.	

CARBONIUM-DYES

Diphenylmethane Dyes

$$\left[\begin{array}{c} X \\ \alpha\text{—}C.. \\ X \end{array}\right] Cl \qquad \begin{array}{c} \alpha = NH_2 \\ X = \text{Aryl} \end{array}$$

Triphenylmethane-Dyes

$$\left[\begin{array}{c} X \\ | \\ X\text{—}C.... \\ | \\ X \end{array}\right] Cl \qquad X = \text{Aryl}$$

including the Phthaleins.

N. B. These dyes are also regarded as *quinoides*, but it is agreed that they are derivatives of trivalent carbon.

No. 655–784.

General Analytical Properties of the Triphenylmethane Dyes.

The detection of dyestuffs on the fibre is treated in a separate section, but in identifying a given colouring matter by special tests the use of the following reagents should be kept in mind:—Concentrated and dilute sulphuric and hydrochloric acids, the dilute acids in both cases being of 10% strength, nitric acid (sp. gr. 1.40), ammonia (sp. gr. 0.91), sodium hydroxide (10% solution) and frequently a hydrochloric acid solution of stannous chloride.

The effect of concentrated sulphuric acid is to combine with the auxochromic amino-groups and inhibit their action, so that Malachite Green, Magenta and Crystal Violet, despite their differences in shade, all give yellow or orange solutions in concentrated sulphuric acid. Concentrated hydrochloric acid produces much the same effect.

10% sulphuric acid will partly combine with auxochromic amino-groups and the same remark holds for hydrochloric acid of moderate dilution. The different brands of Methyl Violet and Crystal Violet give generally green or greenish-blue colorations with 10% sulphuric acid; Malachite Green goes to a darker shade under the same conditions, whilst magenta, if dissolved in concentrated sulphuric acid and then diluted, gives a colourless solution. Generally, however, dilution of a strong sulphuric acid solution of a basic dyestuff eventually restores the original colour when sufficient water has been added to hydrolyse the di- and tri-acid salts which may have been formed.

The action of nitric acid probably gives nitro-derivatives either of the original dyestuff or of its degradation products; the fact that many dyestuffs which give other shades with sulphuric and hydrochloric acid give yellow (brown, etc.) solutions with nitric acid points to a breaking up of the molecule.

Ammonia and sodium hydroxide often produce pale to nearly colourless precipitates in the case of basic dyestuffs of the triphenylmethane series, the solution being decolorised; this behaviour is, of course, explained by the production of colourless carbinol bases. The precipitates of the latter, if collected and dissolved in dilute acids, do not always immediately give solutions of the same shade as the original dyestuffs. This is well seen in the case of Malachite

Green. Addition of alkali produces at first a yellow colour base which passes over gradually into tetramethyldiaminotriphenylcarbinol. The latter forms a colourless or greyish powder; it may be obtained by crystallisation from petroleum spirit as colourless leaflets or crystal aggregates of M. P. 120°. This colourless base dissolves to a nearly colourless solution in dilute acetic acid, the formation of colouring matter taking place by standing some time in the cold or more rapidly on heating. This behaviour is easily explained: a colourless acetate of the carbinol base is first formed which slowly loses water giving the acetate of Malachite Green.

$$C\left\{\begin{array}{l}.C_6H_5\\ .C_6H_4.N(CH_3)_2\\ .C_6H_4.N(CH_3)_2\\ .OH\end{array}\right. \rightarrow C\left\{\begin{array}{l}.C_6H_5\\ .C_6H_4.N(CH_3)_2\\ .C_6H_4.N(CH_3)_2,H.C_2H_3O_2\\ .OH\end{array}\right. \rightarrow$$

$$C\left\{\begin{array}{l}.C_6H_5\\ .C_6H_4.N(CH_3)_2\\ .C_6H_4{:}N(CH_3)_2.C_2H_3O_2\end{array}\right.$$

Stannous chloride in acid solution generally effects a more or less complete reduction to the corresponding leuco-compound; frequently the solutions are completely[1] decolorised, in other cases a difference of shade is observed. The greater or less ease with which the colouring matter is regenerated from the leuco-compound is frequently useful in giving an idea as to the class of compounds to which a given dyestuff belongs. (The process of subsequent reoxidation is of course inapplicable to azo-compounds, since fission at the azo-linkages takes place, but with dyestuffs the molecules of which are not ruptured on reduction, it is frequently of great use.)

A. G. Green has utilised this difference in rate of oxidation of the leuco-compounds in his scheme for the qualitative analysis of artificial dyestuffs (*J. Chem. Soc. Ind.*, 1893, **12**, 3), and points out that there are 2 classes into which the colouring matters may be divided.

1. Colours the leuco-compounds of which are not readily reoxidised on exposure to the air; in this class are included all colouring matters of the triphenylmethane series, the phthaleïns or pyrone colours, indophenols and indamines.

[1] In the case of the triphenylmethane dyes the action with stannous chloride is slow; the different makes of methyl violet acquire a bluish or greenish shade, while magenta and New Fuchsine are only slowly decolorised. Many dyestuffs, on the other hand, with rings of such type as thiazine, acridine, etc., are rapidly decolorised.

2. Colours the leuco-compounds of which are rapidly reoxidised on exposure to air; these colours belong to one of the following classes: azines, oxazines, thiazines, quinoline and acridine colours, hydroxy-anthraquinone colours, thiazole colours and indigo.

In explanation of this difference in behaviour Green has suggested that the colours of Class 1 are of para-quinonoid, those of Class 2 of ortho-quinonoid type (*Proc. Chem. Soc.*, 1892, **8**, 195; 1896, **12**, 226).

The reviser has chosen the simple Carbonium Formula for representing the constitution of this class of dyes, not because he is convinced that it is the only one which is possible, but because it is the simplest one and allows the diphenylmethane dyes, the triphenylmethane dyes and the pyrone dyes to be included in a single group. It must be pointed out, however, that, whilst the first two classes are readily reduced by zinc dust and completely destroyed by too strong action, the pyronines, or pyrone dyes are reduced only, forming leuco-compounds which resist further action—so much so that they cannot be discharged with hydrosulphite on calico. Many of the carbonium dyes are very sensitive to alkali, being decolorised immediately, but others, such as Patent Blue or Rhodamines, are only altered by strong caustic alkali. The shades of the compounds of this group are, as a rule, very pure, but, with the exception of the Violamines, Gallein and Coeruleine, very fugitive to light. They are, nevertheless, among the most important representatives of the artificial dyestuffs and are best characterised by their Absorption Spectra which are very sharp and so characteristic that *no mistake can possibly be made.*

The old distinction between basic or acid dyes has no scientific value at all, because most of these carbonium dyes are met with as basic or acid dyes, having almost the same chemical properties, dissolving freely in water and dyeing wool or silk from an acid bath. Tannin precipitates these dyes, acid or basic, although the basic members are quantitatively precipitated from dilute solution, whilst the more soluble acid dyes, such as Acid Fuchsine, are only partially precipitated.

Auramine O, O conc., II, NAC, OO extra conc., NO, 2, OE, extra conc. (H) (Gy) (S) (SCI) (StD) (A) (B) (By) (C)	A sulphur-yellow powder. H_2O: bright yellow solution, readily decomposed on boiling. Alcohol: yellow solution. HCl to aqueous solution: dark yellow solution which is rendered colourless on boiling	

(L) (MLB) (Mt) (BDC) (DuP) (Gy) (S) (SCI) (StD) (B) (LBH) (DuP) (BDC) (LBH) (S) (A) (B) (NAC) (SCI) (StD) (CN) (StD) (B) (MLB)
Canary Yellow (GrE)
Hydrochloride of tetramethyldiamino-diphenyl-ketonimine.
No. 655 (493)

owing to the formation of ammonium chloride and tetramethyldiaminobenzophenone (Michler's ketone). The latter is precipitated on addition of sodium hydroxide and crystallises from dilute alcohol in colourless plates, M. P. 174°. NaOH: white precipitate of Auramine base, M. P. 130°., soluble in ether; the ethereal solution is coloured yellow by acetic acid. H_2SO_4: colourless solution; pale yellow solution on dilution.

Dyes cotton, mordanted with tannin and tartar emetic at 60°–70°., pure yellow.

Used largely also, in conjunction with other dyes, for the production of green and red shades on cotton; also largely in calico printing for Eastern styles, in spite of its moderate fastness.

Dyes wool from a neutral bath, or from a bath faintly acidified with acetic acid, yellow, but is little used for this purpose.

Level-dyeing 1; relation to cotton, 4; relation to silk, 5.

Used also for dyeing silk, paper, leather, half-silk, jute, coconut-fibre, artificial silk; also for the manufacture of lakes; also in photography for light-filters; also formerly medicinally (Pyoktanium Aureum) for the treatment of malignant growths.

Tetramethyldiaminodiphenyl-aminocarbonium chloride.

Auramine G
(Gy) (SCI) (B) (MLB)
Hydrochloride of dimethyldiamino-ditolyl-ketonimine.
No. 656 (494)

A yellow powder.

H_2O: bright yellow solution, decomposed on boiling.

Alcohol: yellow solution; crystallises from amyl alcohol in plates. HCl to aqueous solution: unaltered cold, but the solution is decolorised on boiling, with formation of ammonium chloride and dimethyldiamino-di-*o*-tolylketone; the latter is precipitated on addition of sodium hydroxide and crystallises from acetone in needles, M. P. 80°–81°. NaOH: white flocculent precipitate of the colour base, M. P. 119°–120°, soluble in ether; the ethereal solution is coloured yellow by acetic acid. H_2SO_4: colourless solution; pale yellow solution on dilution.

Dyes cotton, mordanted with tannin and tartar emetic at 60°–70°, a greener shade of yellow than No. 655.

Dyes wool from a bath faintly acidified with acetic acid yellow, but is little used for this purpose.

	Level-dyeing 1; relation to cotton 3–4; relation to silk 5. Used also in calico printing.
Malachite Green cryst. A (BDC) **Malachite Green** A cryst., cryst., pdr., leuco-base, NB, (sulphate) NJ (oxalate) J3E, cryst., J3ES pdr. BX, B, cryst. extra, B (zinc salt), NN cryst., pdr. superfine B, 4 B, cryst. 3, 4, (CR) (H) (CCC) (HCC) (Hem) (LC) (MOH) (DH) (FB) (JDC) (C) (CJ) (Re) (H) (LBH) (ICA) (LBH) (CN) (StD) (B) (B) (CJ) (MLB) (K) (MLB) (tM) Victoria Green B small crysts., WB cryst, WB cryst. special, WB pdr., WB base. (NAC) (DuP) (B) (tM) (DuP) New Green cryst. BI, BII, BIII, GI, GII, GIII, GS, (tM) (B) (By) (tM) Zinc double chloride or oxalate of *pp*-tetramethyldiaminotriphenylcarbinol-anhydride, or dimethylaminofuchson-dimethylammonium chloride. No. 657 (495)	The oxalate forms green glistening metallic plates, and the zinc double chloride forms prismatic crystals with a beetle-green lustre. The picrate, golden-yellow needles from benzene, is insoluble in water and is used for colouring spirit varnishes. In water: $\lambda = 616.9$. H_2O: bluish-green solution. Alcohol or amyl alcohol: bluish-green solution. HCl to aqueous solution: reddish-yellow solution. NaOH: greenish-white precipitate of the colour-base, which separates from benzene in crystals, M. P. 132°; the ethereal solution of the precipitate is coloured green by acetic acid. H_2SO_4: yellow solution; yellowish-green solution and then green solution on dilution. HNO_3 : yellow. Dyes wool from a faintly acid bath, or wool mordanted with sodium thiosulphate from a neutral bath, green. Level-dyeing 2; relation to cotton, 4; relation to silk, 5. Light: 5–4. Dyes cotton, mordanted with tannin and tartar emetic, bluish-green. *Malachite Green* is much faster to light when dyed on acetate-silk than on other types of artificial silk or on cotton mordanted with tannin and tartar emetic. Used for dyeing and printing cotton, artificial silk and silk; also for dyeing wool, leather, jute and straw, and for colouring paper, wool, inks, &c.; also for the manufacture of lakes; also for colouring fats, oils and waxes. *Malachite Green* (BDC) is used as a microscopic stain.
Setoglaucine O, (Gy) (StD) (Gy) Rhoduline Blue 6G, (By) Hydrochloride of *pp*-tetramethyl-diamino-*o*-chloro-triphenyl-carbinol an-	A copper-red powder. In water: $\lambda = 630.8$. H_2O: moderately soluble cold, readily soluble hot, with a bluish-green colour. Alcohol: readily soluble, with a bluish-green colour. HCl to aqueous solution: reddish-yellow solution. NaOH: blue-black precipitate, chang-

hydride, or dimethyl-amino-*o*-chloro-fuchsin-dimethyl-ammonium chloride. No. 658 (496)	ing to reddish-brown. H_2SO_4: reddish-yellow solution; yellow solution and then green solution on dilution. Dyes silk turquoise-blue, and cotton mordanted with tannin and tartar emetic greenish-blue. Setoglaucine is much faster to light when dyed on acetyl-silk. Used also in calico printing.	
New Fast Green 2B (SCI) *Victoria Green 3B* (B) Manufacture discontinued. Hydrochloride or zinc double chloride of *pp*-tetramethyldiamino-2:5-dichloro-triphenyl-carbinol anhydride, or dimethylamino-2:5-dichloro-fuchson-dimethylammonium chloride. No. 659 (497)	*New Fast Green 2B*— A green metallic glistening powder. In water: $\lambda = 628.1$. H_2O: very sparingly soluble cold, more readily soluble hot, with a greenish-blue colour; the hot solution gelatinises on cooling. Alcohol: readily soluble with a greenish-blue colour. HCl to aqueous solution: yellowish-green solution and then yellow solution. NaOH: reddish-yellow solution with a slight precipitate. H_2SO_4: yellow solution, reddish-yellow solution and then yellowish-green solution on dilution. Dyes silk, and cotton mordanted with tannin and tartar emetic, pure bluish-green, bluer than Malachite Green, No. 657. Used mainly for dyeing cotton and silk, and for printing cotton, silk and half-silk; little used on wool.	
Helvetia Green (Bindschedler & Busch) No longer manufactured. Sodium salt of *pp*-tetramethyldiamino-triphenylcarbinol-monosulphonic acid. No. 660	A light green powder. H_2O: bluish-green solution. Alcohol: sparingly soluble. HCl to aqueous solution: separation of reddish-brown crystals of the sulphonic acid. NaOH: colourless solution, yellowish-green solution and then green solution on dilution. Dyes wool and silk from an acid bath, and cotton mordanted with tannin and tartar emetic, green.	
Turquoise Blue G, B, BB, GG, GL extra, (*BDC*) (*By*) (*By*) Zinc double chloride of tetramethyl-diamino-diphenyl-*p*-nitro-tolylcarbinol-anhydride, or dimethylamino-*p*-nitro-methyl-fuchson-dimethylammonium chloride. No. 661 (498)	BB, G, dark blue powders. In water: BB, $\lambda = 626.5$; G, GL extra, $\lambda = 630.4$. H_2O: blue solution. Alcohol: greenish-blue solution. Amyl alcohol: more sparingly soluble. HCl to aqueous solution: olive solution. NaOH: brown to violet-brown precipitate. H_2SO_4: yellowish-brown solution; green solution and then blue solution on dilution. Dyes cotton mordanted with tannin and tartar emetic, and silk from an acid bath, greenish-blue (BB) or bluish-green (G, GG).	

	Used particularly in calico printing and for the manufacture of lakes, on account of the clear shade and great fastness to alkalies. Discharged white on cotton by chlorate, or by hydrosulphite in presence of caustic soda and Rochelle salt.	
Brilliant Green cryst. (CR) (H) (FB) (By) (GrE) (K) (L) (tM) Sulphate of tetraethyl-diamino-triphenyl-carbinol anhydride, or diethylamino-fuchson-diethylammonium sulphate. No. 662 (499)	Small glistening golden crystals (sulphate). In water: $\lambda = 623.0$. H_2O: green solution. Alcohol: green solution. HCl to aqueous solution: reddish-yellow solution. NaOH: pale green precipitate of the colour-base. H_2SO_4: yellow solution; reddish-yellow solution, yellowish-green solution and then green solution on dilution. Dyes cotton, mordanted with tannin and tartar emetic, a yellower shade of green of less tinctorial power than Malachite Green (No. 657). Dyes wool mordanted with sodium thiosulphate from a neutral bath a brilliant and yellower shade of green than Malachite Green (No. 657). Level-dyeing, 2; relation to cotton, 4; relation to silk, 5. Used also for dyeing silk, jute, leather and paper, for the manufacture of lakes and paints, and as a fat colour (stearate); also in calico printing for pure green shades. Discharged white on cotton by chlorate, or by hydrosulphite in presence of caustic soda and Rochelle salt.	
Setocyanine O, (Gy) (Gy) Hydrochloride of diethyl-diamino-di-*o*-tolyl-*o*-chlorophenol-carbinol anhydride, or ethylamino-*o*-chlorodimethylfuchson-ethylammonium chloride. No. 663 (500)	A greyish-green powder. In water: $\lambda = 612.3$. H_2O: greenish-blue solution hot; the solution gelatinises on cooling. Alcohol: readily soluble. HCl to aqueous solution: yellow solution. NaOH: brownish-yellow precipitate. H_2SO_4: reddish-yellow solution; green solution on dilution. Dyes cotton mordanted with tannin and tartar emetic, and silk, bright greenish-blue. Setocyanine is much faster to light when dyed on acetate-silk. Used also in calico printing. Discharged white on cotton by chlorate, or by hydrosulphite in presence of caustic soda and Rochelle salt.	
Acronal Brilliant Blue (BDC) Zinc double chloride	A glistening reddish-violet coppery powder. In water: $\lambda = 612.3$.	

of dimethyl-diamino-di-*o*-tolyl-*o*-*m*-dichloro-phenylcarbinol-anhydride or methyl-amino-*o*-*m*-dichloro-dimethyl-fuchson-methylammonium chloride No. 664 (501)	H_2O: greenish-blue solution hot (preferably with addition of acetic acid); the solution gelatinises on cooling. Alcohol: blue solution. HCl to aqueous solution: dark green precipitate, or yellow solution with a large excess. NaOH: yellowish-orange precipitate. H_2SO_4: yellow solution, green precipitate on dilution. Dyes silk and wool from a faintly acid bath, and cotton mordanted with tannin and tartar emetic, greenish-blue. Used also for the manufacture of lakes and in wallpaper printing; also in calico printing. Discharged white by chlorate on cotton.	Probably identical with No. 663.
Viridine (*BSS*) No longer manufactured. Sodium salt of diphenyldiamino-triphenylcarbinol-monosulphonic acid. No. 665	A dark green powder. H_2O: green solution. HCl: green precipitate. NaOH: brown solution. H_2SO_4: magenta-red solution, green flocculent precipitate on dilution. Dyes wool green from an acid bath.	
Acid Green G. L extra, B extra, GV, 2BG, extra conc. extra conc. (BDC) (NAC) (SCI) (MLB) (tM) (WDC) New Acid Green 3BX (By) Sodium salt of dibenzyldiethyldiamino-triphenylcarbinol-disulphonic acid anhydride, or of *p*-sulpho-benzylethylamino-fuchson-benzylethylammonium sulphonate. No. 666 (502)	A dull dark green powder. In water: $\lambda = 618.3$. H_2O: green solution. Alcohol: soluble, but less soluble in amyl alcohol. HCl to aqueous solution: brownish-yellow solution. NaOH: blackish-green solution. H_2SO_4: yellow solution; yellowish-red solution and then green solution on dilution. $BaCl_2$: green precipitate. Dyes wool and silk from an acid bath very level green.	
Disulphone Green B (BDC)	A bluish-green powder. In water: $\lambda = 635.4$; *Neptune Green* SG (B) in water: $\lambda = 634.7$.	

Fast Acid Green B, 6B, (NAC) (StD) (GrE) Erioviridine B (Gy) Neptune Green SG (B) Brilliant Acid Green 6B, (By) Fast Wool Green B (K) Patent Green AGL (MLB) Sodium salt of dibenzyldiethyldiamino-*o*′-chloro-triphenylcarbinoldisulphonic acid anhydride or of *p*-sulpho-benzylethylamino-o-chloro-fuchson-benzylethylammonium sulphonate. No. 667 (503)	H_2O: bluish-green solution. Alcohol: readily soluble. HCl to aqueous solution: green precipitate. NaOH: olive-green precipitate, changing to dirty-brown. H_2SO_4: yellowish-red solution, green precipitate on dilution. Dyes wool and silk from an acid bath bluish-green, unaltered by after-chroming. Level-dyeing, 2; relation to cotton, 1; relation to silk, 4. Used also for dyeing unions. Also in mixtures with violet for pure merino blues. In such mixtures the blue is discharged with Rongalite.
Night Green B (*tM*) Sodium salt of dibenzyldiethyldiamino-*o*-chloro-*m*-nitro-triphenylcarbinol disulphonic acid anhydride, or of *p*-sulpho-benzyl-ethyl amino-2-chloro-5-nitro-fuch-son-benzyl-ethylammonium sulphonate. No. 668	A bluish-green powder. H_2O: bluish-green solution. Alcohol: readily soluble. HCl to aqueous solution: green precipitate. NaOH: dull green precipitate. H_2SO_4: yellow solution, yellowish-green precipitate and then bluish-green precipitate on dilution. HNO_3: *id.* Dyes wool and silk bluish-green from an acid bath. Not manufactured.
Acid Green, O bluish, B extra conc., BG, 2B, 3B, B, extra, 6B, BB BN extra, M, bluish— (DH) (L) (SCI)	A brownish-black powder. In water: $\lambda = 627.8$. H_2O: green solution. Alcohol: almost insoluble. HCl to aqueous solution: yellowish-brown solution. NaOH: dull violet precipitate and colourless solution. H_2SO_4: yellow solution, green solution on dilution. $BaCl_2$: no precipitate.

(MLy) (C) (B) (By) (MLB) (NI) Sodium salt of dibenzyldimethyldiamino-triphenyl-carbinol trisulphonic acid anhydride, or of p-sulphobenzylmethylamino-p'-sulphofuchson-benzylmethyl-ammonium sulphonate. No. 669 (504)	Picric Acid: no precipitate (distinction from green basic dyes). Dyes wool and silk from an acid bath a bluer shade of green than Light Green SF yellowish (No. 670); very sensitive to dilute alkalis but not to acids, and not fast to light and milling. Used in printing, for dyeing leather, jute and paper, and also for the manufacture of lakes and inks. Light Green SF: Safranine (BDC) is used as a compound microscopic stain.	
Fast Acid Green N (CCC) Sodium (Light Green SF yellowish) or calcium (Acid Green D) salt of dibenzyldiethyldiamino-triphenyl-carbinol-trisulphonic acid anhydride, or sodium salt of p-sulpho-benzylethylamino-p-sulpho-fuchson-benzylethylammonium sulphonate. No. 670 (505)	Light Green SF yellowish— A reddish-brown powder, or bronzy-coppery flakes. In water: $\lambda = 633.5$. H_2O: green solution. Alcohol: almost insoluble. HCl to aqueous solution: yellowish-brown solution which gradually decolorises. NaOH: almost complete declorisation, of the solution in the cold, and a dull violet precipitate. H_2SO_4: yellow solution; green solution on dilution. Picric acid: no precipitate (distinction from green basic dyes). $BaCl_2$: precipitate of barium sulphate. Dyes wool and silk green from an acid bath. Level-dyeing, 3; relation to cotton, 1; relation to silk, 3. Used also for colouring foodstuffs; Light Green SF yellowish is officially permitted for this purpose in Australia and the United States. Light Green SF: Safranine (BDC) is used as a compound microscopic stain.	
Erioglaucine A, BB, extra, G, JB, P, RB extra, supra X conc., V, (Gy) Acid Brilliant Blue EG (By) Azure Blue AEG (K)	A glistening dark blue-bronzy powder, hygroscopic. In water: $\lambda = 639.0$. H_2O: very soluble, with a greenish-blue colour. Alcohol: soluble. HCl to aqueous solution: green solution and then yellow solution. NaOH: unaltered cold, violet solution on boiling. H_2SO_4: pale yellow solution; green solution and then greenish-blue solution on dilution. Dyes wool and silk from an acid bath level greenish-blue, fast to alkalies and	

Patent Carmine Blue AE, AE extra (MLB) Erioglaucine A— Ammonium salt of dibenzyldiethyl-diamino-tri-phenyl-carbinol trisulphonic acid anhydride, or of *p*-sulpho-benzyl-ethylamino-*o*-sulpho-fuchson-benzylethylammonium sulphonate. No. 671 (506)	acids, and moderately fast to light and washing. **Very important.** Used as a substitute for Indigo Carmine (No. 1180). Light: 3–4.	
Erioglaucine supra (Gy) **Xylene Blue VS, VS conc.** (S) Sodium salt of tetra-ethyldiamino-tri-phenylcarbinol di-sulphonic acid anhydride or of diethyl-amino-*p*-sulpho-fuchson-diethylammonium sulphonate. No. 672 (507)	*Xylene Blue* VS— A violet powder. In water: $\lambda = 638.7$. H_2O: blue solution. Alcohol: blue solution. HCl to aqueous solution: golden-yellow solution. NaOH: blue solution cold, violet solution on boiling. H_2SO_4: pale yellow solution; golden-yellow solution on dilution. Dyes wool and silk pure blue from an acid bath. Used largely in rag-dyeing and for dyeing compound shades.	
Xylene Blue AS (S) Azure Blue Z (K) Erioglaucine X (Gy) Sodium salt of di-benzyldiethyl-diamino-tri-phenylcarbinol-disulphonic acid anhydride or of benzyl-ethyl-amino-*p'*-sulpho-fuchson-benzyl-ethylammonium sulphonate. No. 673 (508)	*Xylene Blue* AS— A blue powder. In water: $\lambda = 638.0$. H_2O: blue solution. Alcohol: blue solution. HCl to aqueous solution: golden-yellow solution. NaOH: blue solution, reddish-violet solution on boiling. H_2SO_4: pale yellow solution; golden-yellow solution on dilution. Dyes wool and silk from an acid bath pure blue, moderately fast to milling on wool. Light: 4–3.	

Chrome Green pdr. (*By*) Tetramethyldiamino-triphenylcarbinol-*m'*-carboxylic acid anhydride- or dimethyl-amino-fuchson-dimethyl ammonium carboxylate. No. 674 (509)	A dark brown powder. In water: $\lambda = 619.2$. H_2O: greenish-blue solution. Alcohol: bluish-green solution. HCl to aqueous solution: yellowish-orange solution. NaOH: solution decolorised or bluish-white precipitate. H_2SO_4: yellowish-orange solution, unaltered on dilution. Dyes chrome-mordanted wool green, moderately fast to milling, but not fast to light: 4. Used mainly in calico printing with chromium acetate; fuller shades are obtained on oiled-cotton.	
Azo Green paste (By) Tetramethyldiamino-triphenyl-carbinol-*m'*-azo-phenol-carboxylic acid anhydride. No. 675 (510)	A dark green paste. In water: $\lambda = 617.1$. H_2O: insoluble cold, sparingly soluble hot with a green colour. Alcohol: sparingly soluble with a green colour. HCl to aqueous suspension: the suspension is coloured brownish-red. NaOH: the suspension dissolves on warming. H_2SO_4: reddish-brown solution, reddish flocculent precipitate on dilution. Dyes chrome-mordanted wool yellowish-green, fast to milling, but not very fast to light. (4–3.) Used also in printing wallpapers in the form of the chromium lake.	
Fuchsine NJ, (TMC) (DH) Para Rosaniline Base (HP) (GrE) (K) Hydrochloride of pararosaniline, or hydrochloride of triamino-triphenyl-carbinol-anhydride, or di-amino-fuchson-ammonium chloride. No. 676 (511)	Glistening crystals resembling cantharides, rather more compact than ordinary Magenta crystals (No. 677). In water: $\lambda = 543.9$ and 487.1. H_2O: sparingly soluble cold with a red colour, more readily soluble hot. Alcohol: readily soluble with a crimson colour. HCl to aqueous solution: yellow solution. NaOH: reddish crystalline precipitate of pararosaniline base. H_2SO_4: yellow solution; pale yellow solution on dilution. Dyes wool, silk and leather direct, and cotton mordanted with tannin and tartar emetic, red. Used only for the manufacture of Diphenylamine Blue (No. 688).	
Magenta P pdr. (BDC) Magenta Fuchsine Cerise	Hydrochloride: small or large glistening crystals resembling cantharides. Sulphate: fine crystalline powder with a green lustre. Acetate: glistening green irregular lumps. In water: $\lambda = 546.5$. and 489.2.	

Mixture of pararosaniline (No. 676) and rosaniline (triamino-diphenyl-tolylcarbinol anhydride) hydrochlorides (or acetates), or diamino-fuchsonammonium chloride (No. 676) and diamino-methylfuchsonammonium chloride, together with higher homologues. No. 677 (512)	H_2O: soluble hot with a red colour, more readily soluble in amyl alcohol (detection in wine). Alcohol: red solution. Ether: insoluble. HCl to aqueous solution: yellow solution. NaOH: reddish precipitate of rosaniline base. H_2SO_4: yellowish-brown solution; almost colourless solution on dilution. Dyes cotton mordanted with tannin and tartar emetic bluish-red. Dyes wool silk and leather direct bluish-red. Used also for colouring foodstuffs; Roseine is officially permitted for this purpose in Australia; also used in calico printing. Discharged white on cotton by potassium sulphite and sodium hydroxide or by hydrosulphite in presence of sodium hydroxide and Rochelle salt, or yellowish: white by chlorate. Basic Magenta (BDC) is used as a microscopic stain and in nitro-cellulose powder.	
Fuchsine NB crysts., NB prd., N Blumps, NB, MLB, (NAC) (Sch) (MLB) **New Magenta,** FCI, O, (By) (GrE) (tM) (GrE) (C) (GrE) (MLB) Hydrochloride of triamino-tritoyl-carbinol-anhydride, or diamino-trimethyl-fuchson-ammonium chloride. No. 678 (513)	A beetle-green powder. In water: $\lambda = 550.9$ and 490.2. H_2O: red solution: more readily soluble than Nos. 676 or 677. Alcohol: readily soluble, with a red colour. HCl to aqueous solution: yellow solution. NaOH: pale red crystalline precipitate of the base on boiling. H_2SO_4: yellow solution; pale red solution on dilution. Dyes cotton mordanted with tannin and tartar emetic bright red, bluer than Magenta (No. 677). Dyes wool silk and leather direct red. Level-dyeing, 1; relation to cotton, 4; relation to silk, 5. Used also in calico printing. Discharged white on cotton by potassium sulphite and sodium hydroxide or by hydrosulphite in presence of sodium hydroxide and Rochelle salt, or yellowish white by chlorate. Not much used.	
Hofmann's Violet R, (BSS) (StD) (tM) Violet 4RN, R, RR, 5R extra, 5R, 2R, (SCI) (Mo) (B) (By) (K) A mixture of methylated or ethylated rosaniline and pararosaniline of varying composition. No. 679 (514)	Red shades, *e. g. Red Violet* 5R extra (B)— A green crystalline powder. H_2O: magenta-red solution. λ: not available. Alcohol: insoluble. HCl to aqueous solution: yellowish-brown solution. NaOH: brown precipitate. H_2SO_4: yellowish-brown solution, unaltered on dilution. Violet shades, *e. g. Hofmann's Violet*— Glistening green lumps. H_2O: bluish-violet solution (readily soluble).	

	Alcohol: insoluble. HCl to aqueous solution: green solution, and then yellow solution. NaOH: brownish-red precipitate. H_2SO_4: brownish-yellow solution: olive-green solution, green solution and then blue solution on dilution. Dyes wool and silk direct, and cotton mordanted with tannin and tartar emetic, violet. Used now only for dyeing silk and in calico printing. Discharged white on cotton by chlorate, or by hydrosulphite in presence of sodium hydroxide and Rochelle salt.	
Methyl Violet 2B, Paris Violet (StD) A mixture of the hydrochlorides of the more highly methylated pararosanilines, containing principally the tetra-, penta- and hexamethyl derivatives. No. 680 (515)	Green metallic glistening lumps or powder. In water: λ = 587.0 and 535.0. H_2O: violet solution. Alcohol or amyl alcohol: violet solution. HCl to aqueous solution: blue solution, then green solution and finally yellowish-brown solution. NaOH: brownish-red coloration and precipitate. H_2SO_4: yellow solution, yellowish-green solution, greenish-blue solution and then violet solution on dilution. *Methyl Violet* 2B— Dyes wool and silk direct violet. Level-dyeing 1; relation to cotton 4; relation to silk 5. Dyes cotton, mordanted with tannin and tartar emetic, violet. Used frequently for topping and brightening other dyes; also for dyeing acetate-silk, on which it yields full bright shades; also for the manufacture of inks, copying pencils, stamp pads, &c.; also in calico printing. Discharged white on cotton by chlorate, or by hydrosulphite in presence of sodium hydroxide and Rochelle salt. *Gentian Violet* (BDC) is used as a microscopic stain. *Pyoktaninum Coeruleum* has been used in ophthalmic surgery and also in general surgery as an antiseptic, but its use has been abandoned, owing to unpleasant secondary effects.	Used for animals.
Crystal Violet Base, E, E new, pdr. 5BO, 6B, P, 5B, bluish, O, extra cryst., crystals, N pdr. (BDC) (S) (StD) (B) (tM) (DuP) (DuP) (tM)	Bronzy glistening crystals (+7H_2O), or cantharides-glistening crystals or powder (anhydrous). In water: λ = 591.0 and 540.5. H_2O: violet solution. Alcohol: violet solution. HCl to aqueous solution: blue solution, then green solution and finally yellow	

(SCI) (A) (By) (C) (MLB)(tM) Hydrochloride of hexamethylpara-rosaniline, or hydrochloride of hexamethyltriamino-triphenylcarbinol anhydride, or tetramethyldiamino-fuchson-dimethylammonium chloride. No. 681 (516)	solution. NaOH: violet precipitate of the colour-base, almost colourless on warming. H_2SO_4: yellow solution, green solution, blue solution and then violet solution on dilution. Dyes wool and silk from an acetic acid bath bluish-violet. Level-dyeing 1; relation to cotton 4; relation to silk 5. Dyes cotton, mordanted with tannin and tartar emetic, bluish-violet. Used also in calico printing. Discharged white on cotton by chlorate, or by hydrosulphite in presence of caustic soda and Rochelle salt. Crystal Violet (BDC) is used as a microscopic stain.
Ethyl Violet *(Gy) (SCI) (B)* Hydrochloride of hexaethylpara-rosaniline, or hydrochloride of hexaethyltriamino-triphenylcarbinol anhydride, or tetraethyl-diamino-fuchson-diethylammonium chloride. No. 682 (518)	A green crystalline powder. In water: λ = 596.9 and 546.5. H_2O: readily soluble with a violet-blue colour. Alcohol: bluish-violet solution. HCl to aqueous solution: green solution and then reddish-yellow solution. NaOH: greyish-violet precipitate, which, when heated, melts to a brown oil and the solution is decolorised. H_2SO_4: brownish-yellow solution; green solution on great dilution. HNO_3: brown. Dyes wool and silk from an acetic acid bath, and cotton, mordanted with tannin and tartar emetic, bluish-violet. Used also in calico printing. Discharged white on cotton by chlorate, or by hydrosulphite in presence of sodium hydroxide and Rochelle salt.
Benzyl Violet 35ON, 7B, (CR) (StD) (R) (StD) (CJ) (tM) Methyl Violet 5B, 6B, 7B, 5B cryst., 6B, 6B extra conc. 10B, (H) (A) (BK) (By) (C) (GrE) (K) (MLB) (NI) (NAC) (MLy) (FB) (tM) A mixture of the hydrochlorides of	Lumps or powder with a bronzy lustre and an odour of benzylethyl-ether. In water: λ = 519.0 and 540.5; *Brilliant Violet* 6B (SCI) in water: λ = 587 and 535.7. H_2O: bluish-violet solution. Alcohol: bluish-violet solution. HCl to aqueous solution: yellowish-brown solution. NaOH: brownish-red precipitate. H_2SO_4: yellow solution, violet solution on dilution. Dyes wool and silk from an acetic acid bath, and cotton, mordanted with tannin and tartar emetic, violet. Used also in calico printing. Discharged white on cotton by chlorate, or by hydrosulphite in presence of sodium hydroxide and Rochelle salt.

benzylated tetra- and pentamethyl-pararosaniline with the hydrochloride of hexamethyl-pararosaniline (No. 681) No. 683 (517)		
Methyl Green cryst., cryst. I yellowish, bluish, (StD) (K) (tM) (A) (*By*) Zinc double chloride of heptamethyl-para-rosaniline chloride, or of chloro-pentamethyl-diamino-fuchson-dimethylammonium chloride. No. 684 (519)	Small green crystals with a golden lustre, or a light green powder. In water: $\lambda = 633.8$. H_2O: bluish-green solution, rendered bluer on boiling. When a filter paper steeped in an aqueous solution of the dye is heated, it is coloured violet owing to the liberation of methyl chloride and formation of Crystal Violet (No. 681). Amyl alcohol: insoluble. HCl to aqueous solution: reddish-yellow solution; yellowish-green solution on dilution with water. NaOH: colourless solution. H_2SO_4: reddish-yellow solution; yellowish-green solution on dilution. Dyes silk from a soap bath green, not fast to ironing.	
Methyl Green (StD) (A) (By) (tM) Ethyl Green Zinc double chloride of ethyl-hexamethyl-pararosaniline bromide, or of bromo-ethyltetramethyl-diamino-fuchson-methylammonium chloride. No. 685	A moss-green crystalline powder. H_2O: readily soluble with a greenish-blue colour. λ = about 628. HCl: green solution and then yellow solution. NaOH: colourless solution or orange-brown precipitate. H_2SO_4: yellowish solution; green solution on great dilution. Dyes wool mordanted with sodium thiosulphate, silk, and cotton, mordanted with tannin and tartar emetic, bluish-green. Used formerly for dyeing cotton and in calico printing. Not manufactured.	
Iodine Green Zinc doube chloride of heptamethyl-rosaniline-chloride, or of chloropenta-methyl-diamine-methyl-fuchson-dimethylammonium chloride. No. 686	Dark green hard lumps. H_2O: readily soluble with a bluish-green colour. A drop of the solution dried on filter paper and heated turns violet. HCl: reddish-yellow solution. NaOH: colourless solution. H_2SO_4: reddish-yellow solution; pale yellowish-green solution on dilution. When heated with concentrated sulphuric acid, iodine vapours are evolved, if prepared with methyl iodide. Dyes silk green from a soap bath. Not manufactured.	

Regina Purple (BSS) (WSS) A mixture of the acetate of monophenyl- or mono-*o*-tolyl-rosaniline with the corresponding derivatives of para-rosaniline. No. 687	A green powder. H_2O: readily soluble with a reddish-violet colour. HCl: brown solution; blue solution on dilution with water. NaOH: brown precipitate. H_2SO_4: brown solution; brown solution and then blue solution on dilution; when warmed with sulphuric acid and alcohol, ethyl acetate is evolved. Dyes wool direct reddish-violet, relatively fast but not bright. Used for dyeing wool.	
Light Blue Superfine spirit-soluble. (MLB) *Methyl Blue spirit-soluble.* Hydrochloride or acetate of triphenyl-pararosaniline, or hydrochloride of triphenyltriamino-triphenylcarbinol anhydride or diphenyl-amino-fuchson-phenyl-ammonium chloride. No. 688 (520)	A brown powder. In alcohol: λ = about 597.5. H_2O: insoluble. Alcohol: sparingly soluble cold, more readily hot, with a blue colour. H_2SO_4: brownish-yellow solution, blue precipitate on dilution. The picrate formed in benzene solution is very characteristic and crystallises in bronzy, glistening plates, containing one molecule of benzene of crystallisation. Dyes silk from a soap bath acidified with sulphuric acid, to which a hot alcoholic solution of the dye is added, blue. Used as the raw material for the manufacture of water-soluble sulphonated blue dyes (Nos. 703, 705, 706); also formerly in calico printing.	
Spirit Blue 2B (BDC) **Blue II spirit-soluble.** (MLB) Hydrochloride, sulphate or acetate of variable mixtures of phenylated para-rosaniline and rosaniline. No. 689 (521)	Hydrochloride: greyish-green crystalline powder; sulphate and acetate: bluish-violet powders. In alcohol: about λ = 597.5. H_2O: insoluble. Alcohol: acetate: readily soluble; sulphate and chloride: more sparingly soluble, with a blue colour. HCl to alcoholic solution: unaltered. NaOH: brownish-red solution. H_2SO_4: brownish-yellow solution, blue precipitate of the sulphate on dilution. Dyes silk from a soap bath acidified with sulphuric acid, to which a hot alcoholic solution of the dye is added, greenish-blue. Used for colouring spirit varnishes, for colouring paper (as sulphate), and formerly in calico printing, but used mainly as the raw material for the manufacture of Alkali Blues (No. 704) and Soluble Blues (No. 707) by sulphonation.	
Victoria Blue 4R, (S) (SCI) (A) (B) (K) (MLB) (tM)	A glistening bronzy powder. In water: λ = 593.5 and 538.5. H_2O: bluish-violet solution hot.	

Fat Blue 4R (SCI) Hydrochloride of pentamethyl-α-naphthyl-pararosaniline- or hydrochloride- of pentamethyl-α-naphthyl-triamino-triphenylcarbinol anhydride, or dimethylamino-methyl-α-naphthylamino-fuchson-dimethyl-ammonium chloride. No. 690 (522)	Alcohol: blue solution. HCl to aqueous solution: precipitate which dissolves, first to a green solution and then to a yellowish-brown solution with a large excess. NaOH: violet-brown precipitate. H_2SO_4: yellowish-brown solution; green solution and then blue solution on dilution. Dyes wool and silk from an acetic acid bath, and, cotton mordanted with tannin and tartar emetic, blue, much redder than Victoria Blue B (No. 729). Used also in calico printing. Discharged white by chlorate on cotton.
Fast Green bluish, extra, extra bluish, CR, W, (*By*) Sodium salt of tetramethyldibenzyl-triamino-triphenyl-carbinol-disulphonic acid anhydride, or of dimethylamino-sulpho-*m'*-dibenzyl-amino-fuchson-dimethyl-ammonium sulphonate. No. 691 (523)	A dark bluish-green crystalline powder. In water: Fast Green extra bluish: $\lambda = 629.5$ and 580.7. H_2O: greenish-blue solution. Alcohol: soluble. HCl to aqueous solution: yellow solution; greenish-yellow solution on dilution with water. NaOH: colourless solution on warming. H_2SO_4: yellowish-red solution; almost colourless solution on moderate dilution, but greenish-blue solution on great dilution. Dyes wool and silk from an acid bath bluish-green, moderately fast to light and milling, and not sensitive to dilute acids or alkalies.
Acid Magenta conc, N.O, (BEL) (CAC) (H) (J W L) (S) (CV) (LBH) (Sch) Acid Fuchsine S, NS, B, O, G, (DH) (RF) (StD) (By) (C) (GrE) (WDC) (A) (GrE) (K) (MLB) (L) (tM)(MLB) (MLB) A mixture of the sodium or ammonium salts of the di- and trisulphonic acids of Para-rosaniline and Rosaniline. No. 692 (524)	Glistening metallic-green granules or dark red powder. In water: *Fuchsine S* (B): $\lambda = 549.5$ and 538.0. H_2O: bluish-green solution. Alcohol: almost insoluble. HCl to aqueous solution: unaltered. NaOH: almost completely decolorised, but the colour returns with acids, even with carbon dioxide. H_2SO_4: yellow solution; gradual change to red solution, on dilution. Dyes wool from an acid bath, and silk from an acidified soap bath, red. Level-dyeing, 2–3; relation to cotton, 1; relation to silk, 2. Light: 4–5. Acid Magenta (BDC) is used as a microscopic stain. Very little used to-day.
Red Violet 5RS (*B*) A mixture of the sodium salts of the di- and trisulphonic acids of ethyl-rosaniline. No. 693 (525)	Glistening brownish-violet metallic lumps. In water: $\lambda = 551.3$ and 419.3. H_2O: magenta-red solution. Alcohol: insoluble. HCl to aqueous solution: unaltered. NaOH: light brownish-yellow solution. H_2SO_4:

No. 700 (532)	Dyes wool bluish-violet from an alkaline, neutral or acid bath. Level-dyeing, 2: relation to cotton, 4; relation to silk, 4. Used also for blueing white silk.	
Acid Violet 7BN, (MLB) Sodium salt of tetramethyldiphenyl triamino-triphenyl-carbinol disulphonic acid anhydride, or of dimethyl-sulphodiphenyldiamino-fuchson-dimethylammonium sulphonate. No. 701 (533)	A bluish-violet powder. In water: λ = 603.0 and 547.5. H_2O: blue solution. Alcohol: sparingly soluble with a blue colour. HCl to aqueous solution: green solution; blue solution on dilution with water. NaOH: colourless solution on warming. H_2SO_4: orange-yellow solution; blue solution on dilution. Dyes wool and silk bluish-violet from an acid bath. Light: 4.	
Acid Violet 7B (SCI) (B) Sodium salt of dimethyldiethyldiphenyltriamino-triphenyl carbinol-disulphonic acid anhydride, or of dimethyl-sulpho-diphenyldiamino-fuchson-diethylammonium sulphonate. No. 702 (534)	A brownish-violet powder. In water: λ = 607.5 and 544.5. H_2O: bluish-violet solution. Alcohol: bluish-violet solution. HCl to aqueous solution: bluish-violet precipitate, grass-green solution with excess. NaOH: bluish-violet precipitate cold, colourless solution on warming. H_2SO_4: orange-brown solution; olive-green solution and then bluish-green solution on dilution. Dyes wool, and silk moderately level bluish-violet from an acid bath. Light: 4.	
Alkali Blue 6B, D, (H) (WSS) (SCI) (MLy) (StD) (C) (A) Methyl Alkali Blue (TMC) (DH) (Gy) (B) (GrE) (K) (MLB) Sodium salt of triphenyltriamino-triphenylcarbinol sulphonic acid. No. 703 (535)	A blue powder. In water: λ = 557.0. H_2O: insoluble cold, blue solution hot. Alcohol: greenish-blue solution. HCl to aqueous solution: blue precipitate. NaOH: reddish-brown solution. H_2SO_4: reddish-brown solution, blue precipitate on dilution. Dyes wool from an alkaline bath containing borax in the form of the carbinol, converted, after washing, into blue by passing throught a dilute acid bath. Level-dyeing, 1; relation to cotton, 4; relation to silk, 4. Indispensable for Silk-Blue. Light: 4–3.	
Alkali Blue 4B, (BDC) (SCI) (StD) (Ib) (By) (K) (MLB)	A blue powder. In water: *Alkali Blue* B: λ = 543.0, *Alkali Blue* 3R conc.: λ = 545.5. H_2O: colourless solution. Alcohol: somewhat soluble. HCl to aqueous solution: blue precipitate.	

A mixture of the sodium salts of triphenyl-para-rosaniline-mono-sulphonic acid (No. 703) and di-phenyl-rosaniline monosulphonic acid, or diphenyl-triamino-di-phenyltolyl-carbinol-sul-phonic acid. No. 704 (536)	NaOH: reddish-brown solution. H_2SO_2: brownish-red solution; blue precipitate on dilution. Dyes wool from a boiling alkaline bath containing borax in the form of the carbinol, converted, after washing, into blue by passing through a dilute acid bath. Level-dyeing, 1; relation to cotton 4; relation to silk, 4. Light: 4–3.	
Soluble Methyl Blue (WSS) (Gy) **Methyl Blue water-soluble** (Gy) Methyl Blue MBS, MBS for Silk, for Silk MLB, 3G (B) (GrE) (MLB) (tM) Sodium salt of tri-phenyltriamino-tri-phenylcarbinol disul-phonic acid anhy-dride (with some monosulphonic acid), or of sulpho-di-phenyldiamino-fuchsan-phenylam-monium sulphonate. No. 705 (537)	A dark blue powder, or lumps with a coppery lustre. In water: *Methyl Blue water-soluble* (Gy): $\lambda = 558$. H_2O: blue solution. Alcohol: greenish-blue solution. HCl to aqueous solution: more intense blue solution. NaOH: brownish-red solu-tion. H_2SO_4: yellowish-brown solu-tion; blue solution on dilution. Dyes silk blue from a faintly acid soap bath.	
Soluble Blue 8B, 10B, 3R, (BSS) (WSS) (BSS) (DuP) **Methyl Cotton Blue** MBJ, MLB, (Gy) (SCI) (K) (GrE) (MLB) Helvetia Blue stand-ard, No. 1 (Gy) Sodium salt of tri-phenyltriamino-triphenylcarbinol tri-sulphonic acid anhy-dride, together with some disulphonic acid when prepared by process (a), or sodium salt of sul-	A dark blue powdor. In water: *Helvetia Blue* (Gy): $\lambda = 607.0$. H_2O: blue solution. HCl: unaltered at first, blue precipitate with a large excess. NaOH: reddish-brown solution. H_2SO_4: reddish-brown solution; blue solution on dilution. Dyes silk, and cotton mordanted with tannin and tartar emetic. Used mainly for cotton and writing ink. Light: 4–3 (Blue-black inks).	

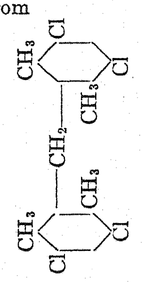
phо-diphenyldi-amino-fuchson-sulpho-phenyl-ammonium sulphonate (b). No. 706 (538)		
Water Blue, various brands (R and B), BJJ, SV, (TMC) (JDC) (CR) (HM) (Gy) (S) (SCI) (HR)(A)(B)(By) (C)(K)(L)(MLB) (WDC) (GrE) (MLB) Cotton Blue, 3B, extra, conc. R, No. 1, No. 2, (Sch) (L) (NI) (Gy) (MLB) Light Blue Superfine water-soluble (MLB) Sodium, ammonium or calcium salt of the trisulphonic acid, together with some disulphonic acid, of triphenyltri-amino-triphenyl-carbinol anhydride (No. 706), and of diphenyl-triamino-diphenyl-tolylcarbinol anhydride, or phenyldi-amino-sulpho-methyl-fuchson-sulpho-phenylammonium sulphonate (below). No. 707 (539)	A glistening blue powder, lumps or coppery flakes. In water: Water Blue 2B: (SCI): λ = 546.5. H_2O: blue solution. Alcohol: almost insoluble. HCl to aqueous solution: partial precipitate (the disulphonic acid), but the colour of the solution remains unaltered. NaOH: brownish-red solution. H_2SO_4: reddish-yellow solution, blue precipitate and blue solution on dilution. Dyes wool and silk: blue from an acid bath. *Water Blue SV* (MLB)— Level-dyeing, 4; relation to cotton, 4; relation to silk, 4. Dyes cotton, mordanted with tannin and tartar emetic, and jute, blue. Very important blue used for writing-ink; also for ribbons. Cotton Blue extra (MLB)—	
Hoechst New Blue (MLB) Calcium (or sodium salt of the di- and	A dark blue powder. H_2O: blue solution. λ = 600.0. Alcohol: very sparingly soluble. HCl to aqueous solution: partial precipitate	

trisulphonic acids of trimethyl-triphenyl-triamino-triphenyl-carbinol anhydride. No. 708)	(the disulphonic acid) but the colour of the solution remains unaltered. NaOH: colourless solution. H_2SO_4: brownish-red solution; blue solution and precipitate on dilution. Dyes wool from a boiling neutral bath (which contains about one-third more colouring matter than the shade requires) in the form of the carbinol, converted, after washing, into blue by passing through a dilute acid bath; silk is dyed from a faintly acid soap bath. Light: 4–3.
Pacific Blue (H) Components— Diamino-diphenyl-methane and Pararosaniline (No. 676); and Sulphonate. No. 709 (540)	Powder or crystals with a coppery lustre. H_2O: blue solution. λ = about 605.0. HCl: greenish-yellow solution. NaOH: precipitate. Dyes wool or unmordanted cotton greenish-blue. Light: 3–4.
Brilliant Pure Blue 5G, **(By)** **Brilliant Sky Blue 5G,** (By) **Brilliant Cotton Blue 6B,** (K) Brilliant Dianil Blue 6G, (MLB) Sodium salt of sulphonic acids of β-naphthylated rosaniline. No. 710 (541)	*Brilliant Dianil Blue* 6G (MLB)— Lumps with a metallic lustre, or dark blue powder. In water: λ = 583.75 and 539.5. H_2O: blue solution. Alcohol: insoluble. HCl to aqueous solution: blue precipitate. NaOH: dull claret red solution. H_2SO_4: reddish-brown solution, blue precipitate on dilution. Dyes silk from a soap bath, and cotton from a bath containing alum and sulphuric acid, blue, not fast to light or washing. Light: 4. *Alkali Blue XG* (BSS)— Greyish-black lumps. H_2O: greenish-blue solution. HCl: blue precipitate. NaOH: violet-black solution, and precipitate cold, resinous precipitate and colourless solution hot. H_2SO_4: reddish-brown solution, blue precipitate on dilution. Dyes wool, from a boiling alkaline bath containing borax, in the form of the carbinol, converted, after washing, into greenish-blue by passing through an acid bath.
Agalma Green B (*B*) Sodium salt of tetramethyl-sulpho-di-nitrophenyltriamino-triphenyl-carbinol-sulphonic acid anhydride, or of dimethyl-sulpho-dinitro-phenyldiamino-fuch-	A greenish-black powder. In water: λ = 626.5. H_2O: green solution. Alcohol: green solution hot. Amyl alcohol: almost insoluble. HCl to aqueous solution: brownish-yellow solution. NaOH: blue solution. H_2SO_4: dull yellow solution; yellowish-brown solution on dilution.

son-dimethylammonium sulphonate. No. 711 (542)	Dyes wool and silk from an acid bath level yellowish-green of good fastness to alkalies, milling and washing, rendered faster by after-chroming. Light: 4. Not used.	
Kiton Fast Blue V (SCI) **Patent Blue V,** V, N, L, superfine, conc., extra, (A) (MLB) Brilliant Acid Blue V (By) Calcium, magnesium or sodium salt of the disulphonic acid of *m*-hydroxy-tetraethyl-diamino-triphenylcarbinol-anhydride, or of diethylamino-sulpho-*m′*-hydroxy-fuchson-diethylammonium sulphonate. No. 712 (543)	A copper-red or blue powder. In water: $\lambda = 638.0$. H_2O: readily soluble with a blue colour. Alcohol: sparingly soluble with a blue colour. HCl to aqueous solution: green solution and then yellow solution. NaOH: unaltered cold, violet solution hot. H_2SO_4: yellowish solution; deep yellow solution and then green solution on dilution. Dyes wool greenish-blue from an acid bath. The dyed shade appears greener in artificial light than in daylight. Level-dyeing 1; relation to cotton, 1–2; relation to silk, 4. Light: 4. Used as a substitute for Indigo Carmine (No. 1180), as it is faster to light than the latter; also for dyeing weighted silk, jute, feathers and artificial flowers; also for the manufacture of inks and pigment colours. Very much used. Fast to chroming.	
Cyanine B (*MLB*) Components— Patent Blue (No. 712) No. 713 (544)	A dark blue powder. In water: $\lambda = 630.4$. H_2O: readily soluble, with an indigo-blue colour. Amyl alcohol: sparingly soluble. HCl to aqueous solution: green solution and then yellow solution. NaOH: unaltered cold, violet solution hot and dark green solution on cooling. H_2SO_4: brownish-yellow solution, yellow solution; green solution and then blue solution on dilution. Dyes wool indigo blue from an acid bath and possesses a greater affinity for the fibre than Patent Blue (No. 712). Level-dyeing, 1; relation to cotton, 1; relation to silk, 3. Light: 3–4.	
Xylene Blue A (S) Patent Blue A (A) (K) (MLB) Neptune Blue B	A copper-red powder. In water: Patent Blue A (MLB): $\lambda = 636.4$. H_2O: readily soluble with a blue colour. Alcohol: sparingly soluble. HCl to aqueous solution: green solution and precipitate. NaOH: unaltered cold,	

(B) Brilliant Acid Blue A (By) Calcium salt of the disulphonic acid of *m′*-hydroxy-dibenzyl-diethyl-diamino-triphenylcarbinol anhydride, or of benzyl-ethyl-amino-sulpho-*m′*-hydroxy-fuchson-benzyl-ethylammonium sulphonate. No. 714 (545)	violet solution and precipitate hot. H_2SO_4: yellow solution; green solution and precipitate on dilution. Dyes wool greenish-blue from an acid bath or from a neutral bath. Level-dyeing, 2–3; relation to cotton, 3; relation to silk, 4. Light: 3–4. Used largely for shading woollen goods dyed with chrome-mordant colours	
Cyanol FF, extra FF, (MLy) (C) (StD) Sodium salt of *m′*-hydroxy-diethyl-diamino-phenyl-ditolylcarbinol disulphonic acid anhydride, or of ethylamino-sulpho-*m′*-hydroxy-dimethyl-fuchson-ethylammonium sulphonate. No. 715 (546)	*Cyanol FF* (C)— A black-blue powder. In water: λ = 613.2. H_2O: readily soluble with a blue colour. HCl: green solution and then yellow solution. NaOH: dichroic green and red solution, converted into wine-red on boiling. H_2SO_4: yellow solution; yellowish-green solution and then blue solution on dilution. Dyes wool from an acid bath, and silk from an acidified soap bath, level pure blue of good fastness to washing, alkalies and acids, and of moderate fastness to light and milling. Used as a substitute for Indigo Carmine (No. 1180). *Xylene Cyanol* FF (S) is also valuable as an addition to Methyl Orange (No. 142) in acid and alkali titrations for improving the colour change of the indicator; 1.4 parts of the former are used to 1 part of the latter dissolved in 500 parts of 50% alcohol: (Hickman and Linstead).	
Ketone Blue 4BN solu- or pdr. (MLB) Components— Methyl-diphenylamine and Methoxy-dimethyl-aminobenzophenone; and Sulphonate. No. 716 (547)	A dark blue solution or reddish-violet powder. In water: λ = 620.7. H_2O: readily soluble with a blue colour. Alcohol: soluble. HCl to aqueous solution: faint green solution. NaOH: brownish-red solution. H_2SO_4: reddish-yellow solution; bluish-green solution on dilution. Dyes wool and silk level pure blue, fast to acids and washing. Light: 3–4.	

Acid Violet, 6B, 6 B N, 6 B N O, 6BNOO, 6BV, (H) (SCI) (B) (MLB) (SCI) (B) (B) (K) Sodium salt of tetramethyl-*p*-tolyl-triamino-ethoxy-triphenyl-carbinol trisulphonic acid anhydride, or of dimethyl-*p*-tolyl-diamino-disulpho-ethoxy-fuchson-dimethylammonium sulphonate. No. 717 (548)	A dark bluish-violet powder. In water: λ = 618.3. (See No. 696, which seems to be identical.) H_2O: bluish-violet solution. Alcohol: bluish-violet solution. HCl to aqueous solution: violet-red solution, reddish-brown solution with excess. NaOH: slowly decolorised. H_2SO_4: orange-red solution; violet-red solution and then bluish-violet solution on dilution. Dyes wool and silk from an acid bath violet-blue bluer than Acid Violet 4BN (No. 695). Level-dyeing, 2–3; relation to cotton, 2; relation to silk, 4. Light: 3. Very important. Made from "Vaste ketone" from Auramine O.
Brilliant Chrome Violet 4B paste (LBH) Chrome Violet paste (*By*) Tetramethyldiamino-*p'*-hydroxy-triphenyl-carbinol-*m*-carboxylic acid anhydride, or dimethyl-amino-p'-hydroxy-fuchson-dimethyl-ammonium carboxylate. No. 718 (549)	A black paste or powder. In water: λ = 610.2. H_2O: sparingly soluble with a green colour. Alcohol: sparingly soluble, with a reddish-violet colour; the solution turns blue on the surface. HCl to aqueous solution: reddish-brown solution. NaOH: reddish-violet solution and black precipitate. H_2SO_4: yellowish-brown solution; reddish-brown solution on dilution. Dyes chrome-mordanted wool violet, moderately fast to washing and milling, but not fast to light. (4–5.) Used mainly in calico printing with a chromium mordant.
Chrome Bordeaux paste, 6B double paste. (*By*) Amino-hydroxy-tetramethyldiamino-triphenylcarbinol-carboxylic acid anhydride, or amino-hydroxy-dimethyl-amino-fuchson-dimethylammonium carboxylate. No. 719 (550)	A reddish-brown paste. H_2O: insoluble. Sol. in Na_2CO_3: orange. Alcohol: red solution on boiling. HCl to alcoholic solution: scarcely altered. NaOH: brownish-red solution. H_2SO_4: bluish-red solution, reddish-brown precipitate on dilution. HNO_3: orange. Dyes chrome-mordanted wool Bordeaux-red, moderately fast to washing and milling, but not fast to light, or cotton mordanted with alumina, or alumina and iron, and treated with tannin dull wine-red and chocolate respectively. Light: 4–5. Used mainly in calico printing with a chromium mordant.

Eriochrome Azurol B (Gy) Sodium salt of 2′:6′-dichloro-hydroxy-dimethyl-fuchson-dicarboxylic acid. No. 720 (551) Similar **E. Ch. Azurol B. X.** from 	A brown powder. In water: partial absorption in the blue and violet; after addition of potassium hydroxide, $\lambda = 598$ and 554.1. H_2O: brownish-yellow solution. Alcohol: more sparingly soluble than in water. HCl to aqueous solution: red precipitate. NaOH: violet-blue solution. H_2SO_4: red solution, red precipitate on dilution. Dyes wool from an acid bath Bordeaux red, converted by after-chroming into pure blue, or chrome-mordanted wool, or wool from a single bath with metachrome mordant. The best colour of this class. Level-dyeing, 2–3, relation to cotton, 1; relation to silk, 2–3. Light: 3.
Chromal Blue G conc. G for printing, (Gy) Components—. *o*-Cresotinic acid and an *o*-Chloro-nitro-derivative of benzaldehyde. No. 721 (552)	A brown powder. H_2O: readily soluble with a brownish-yellow colour. Alcohol: more sparingly soluble than in water. HCl to aqueous solution: red precipitate. NaOH: violet-blue solution. H_2SO_4: bluish-red solution, red precipitate on dilution. Used in calico printing with chromium acetate for pure greenish-blue of rather good fastness. Light: 3–4. Not much used.
Eriochrome Cyanine R (Gy) Sodium salt of *o*′-sulpho-hydroxy-dimethyl-fuchson-dicarboxylic acid. No. 722 (553)	A brick-red powder. In water: partial absorption in the blue and violet; after addition of potassium hydroxide: $\lambda = 587.5$ and 544.5. H_2O: red solution. Alcohol: orange-yellow solution. HCl to aqueous solution: red precipitate with a concentrated solution, orange-yellow solution with a dilute solution. NaOH: reddish-violet solution. H_2SO_4: orange-red solution, red precipitate and then orange-yellow solution on dilution. Dyes wool from an acid bath red, converted by after-chroming into violet-blue. Light: 3–4. Level-dyeing, 3; relation to cotton, 1; relation to silk, 3–4. Used also in calico printing with a mixed chromium and ferricyanide mordant.
Chrome Azurol S, S conc. (Gy) Sodium salt of sulpho-	A brown powder. In water: partial absorption in the blue and violet; after addition of potassium hydroxide, $\lambda = 601.9$ and 559.0.

dichloro-hydroxy-dimethyl-fuchson-dicarboxylic acid. No. 723 (554)	H_2O: brownish-yellow solution. Alcohol: more sparingly soluble than in water, with a brownish-yellow colour. HCl to aqueous solution: orange-red precipitate with a little acid, brownish-red precipitate with excess. NaOH: violet-blue solution. H_2SO_4: raspberry-red solution, brownish-red precipitate and then orange-yellow precipitate on dilution. Dyes wool from an acid bath Bordeaux-red, converted by after-chroming into pure blue, fast to alkalies. Light: 3–4. Used also in calico printing with a chromium mordant.	
Aurine (Gr) (Lo) (RD) A mixture of Aurine (Pararosolic acid or Dihydroxy-fuchson), oxidised Aurine, Methylaurine and Pseudo rosolic acid (Corallinephthalein). Pseudorosolic acid is the chief constituent of commercial Aurine. No. 724 (555)	*Aurine*— Yellowish-brown lumps with a dark greenish-fracture. In water: *Pararosolic acid:* on addition of potassium hydroxide, λ = 534.6 and 479.5. H_2O: insoluble. Alcohol: golden-yellow solution. HCl to alcoholic solution: unaltered. NaOH: cherry-red solution. H_2SO_4: yellow solution. Used for colouring spirit varnishes and lacquers, for photographic purposes, and as an indicator in analytical chemistry (Rosolic Acid). Aurine is poisonous.	
	Yellow Coralline— Metallic green glistening lumps. H_2O: red solution. Alcohol: magenta-red solution. HCl to aqueous solution: brownish-yellow precipitate. NaOH: unaltered. H_2SO_4: yellow solution; yellow solution and precipitate on dilution. Used for the manufacture of Turkey Red coloured lakes for wallpaper printing, paper staining &c. Light: 4. Coralline renders photographic emulsions markedly sensitive to yellow light (Vogel).	
Pittacal Eupittone *Eupittonic Acid* Hexamethoxy-Aurine or Hexamethoxy-dihydroxy-fuchson. No. 725	An orange-crystalline powder, M. P. 200° (decomp.). Alcohol: brown solution. HCl: red solution. NaOH: blue solution. H_2SO_4: red solution, converted into blue by warming. λ: has never been determined. Dyes animal fibres orange from an acid solution or bluish-violet from an ammoniacal solution, particularly in presence of tin mordants.	

Aurine R Probably a Pararosolic acid salt of Pararosaniline, forming an intermediate stage in the conversion of Pararosolic acid into Pararosaniline. No. 726 (556)	Not manufactured. One of the oldest Dyes (V. Reichenbach 1835). A reddish-brown powder. H_2O: sparingly soluble cold, red solution hot. Alcohol: reddish-brown solution. HCl to aqueous solution: yellow solution. NaOH: scarcely altered. H_2SO_4: brownish-yellow solution; yellow solution; yellow solution on dilution. Used for the manufacture of lakes. Scarcely used.	
Chrome Violet CG, pdr. (DH) (Gy) Chrome Rubine (By) Sodium salt of the tricarboxylic acid of Aurine, or of dihydroxy-fuchson-tricarboxylic acid. No. 727 (557)	A chocolate brown powder. H_2O: dark red solution. Alcohol: insoluble. HCl to aqueous solution: precipitate of the free colour-acid. NaOH: light brown solution, H_2SO_4: brown solution, precipitate of the colour-acid on dilution. Dyes chrome-mordanted cotton reddish-violet, fast to soap. Light: 3–4. Used mainly in calico printing with a chromium mordant.	Erio chrome-geranol B is made from *o*-cresotinic acid and formaldehyde.
Victoria Blue R (DuP) (SCI) (StD) (A) (B) (MLB) (tM) New Victoria Blue R, B, (By) (K) (By) Corn Blue B (WDC)″ Hydrochloride of tetramethyl-ethyl-triamino-diphenyl-α-naphthyl-carbinol anhydride. No. 728 (558)	A blue or grey powder. In water: $\lambda = 614.7$ and 558.0. H_2O: sparingly soluble cold, blue solution hot; small green glistening crystals of the hydrochloride separate from the latter solution on cooling. Alcohol: blue solution. HCl to aqueous solution: yellowish-brown solution; green solution on dilution with water. NaOH: brown flocculent precipitate. H_2SO_4: brownish-yellow solution; light green solution to blue solution on dilution. Dyes wool and silk from an acid bath, and cotton mordanted with tannin and tartar emetic blue, redder than Victoria Blue B (No. 729). Used also in calico printing. Light: 4–5. Discharged white on cotton by chlorate, or by hydrosulphite in presence of caustic soda and Rochelle salt.	
Victoria Blue B, B conc, BX, B base NB, NB base. (H) (CCC) (S) (SCI) (StD) (A) (B) (By) (MLB) (tM) (DuP) (DuP) (B) (CN) (CN) Hydrochloride of	Bronzy glistening granules or violet powder. In water: $\lambda = 619.2$ and 567.0. H_2O: sparingly soluble cold, readily soluble hot, with a blue colour. Prolonged boiling precipitates the free colour-base as a reddish resinous precipitate, but the addition of acetic acid prevents this. Alcohol: readily soluble with a pure blue colour. HCl to aqueous solution: blue precipitate, soluble in excess, forming a green solution, and with a	

tetramethyl-phenyl-triamino-diphenyl-α-naphthyl-carbinol anhydride. No. 729 (559)	large excess, forming a yellowish-brown solution. NaOH: dark reddish-brown precipitate. H_2SO_4: reddish-brown solution; yellow solution, green solution and then blue solution on dilution. Dyes wool and silk from an acetic acid bath, or from a sulphuric acid and Glauber's salt bath, and cotton direct from an acetic acid bath, or after previous mordanting with tannin and tartar emetic or with alum, blue. Calcareous water must be corrected with acetic acid. Level-dyeing, 2; relation to cotton, 4; relation to silk, 5. Light: 4–5. Used also in calico printing. Discharged white on cotton by chlorate, or by hydrosulphite in presence of caustic soda and Rochelle salt.
New Green (*MLB*) Hydrochloride of dimethylphenyldiamino-diphenyl-α-naphthyl-carbinol anhydride. No. 730	Used in calico printing for yellowish-green shades. λ: not known. Light: 4–5.
Night Blue **(S) (SCI) (B)** Phosphate or hydrochloride of tetraethyl-*p*-tolyltriamino-diphenyl-α-naphthyl-carbinol anhydride. No. 731 (560)	A violet powder with a bronzy lustre. In water: λ = 568.2 and 627.3. H_2O: bluish-violet solution, more soluble on addition of acetic acid. Alcohol: readily soluble with a violet colour. HCl to aqueous solution: violet precipitate, soluble in excess, forming a green solution, or in a large excess forming yellowish-brown solution. NaOH: pale reddish-brown precipitate of the colour-base. H_2SO_4: yellowish-brown solution; green solution and then blue solution on dilution. Dyes wool and silk from an acetic acid bath, and cotton, mordanted with tannin and tartar emetic, pure blue, moderately fast to water and soap, but not fast to light. The shade is greener than that of Victoria Blue B (No. 729). The use of calcareous water must be avoided. Light: 4–5. Night Blue forms insoluble compounds with many dyestuffs, such as Picric Acid, Naphthol Yellow S, etc. Used also for the quantitative estimation of Naphthol Yellow S, Picric Acid, &c. In the case of Naphthol Yellow S the insoluble compound appears to be formed from 2 molecular propor-

	tions of Night Blue and 1 molecular proportion of Naphthol Yellow S.
Acid Violet 5*BNS*, 6*BNS*, 7*BNS* (S) Sodium salt of sulphonated penta-methylphenyltriaminodiphenyl-β-naphthylcarbinol anhydride. No. 732 (561)	A dark violet powder. In water: λ = 605.8 and 541.5. H_2O: violet solution. Alcohol: violet solution. HCl to aqueous solution: violet precipitate, soluble in excess to form a green solution, or in a large excess to form a yellowish-brown solution. NaOH: blue solution cold, lighter coloured solution on warming. H_2SO_4: yellowish-brown solution; green solution and then blue solution on dilution. Dyes wool from an acid bath bluish-violet of rather good fastness to alkalies. Light: 4.
Fast Acid Blue B (By) *Intensive Blue* (By) Sodium salt of tetramethyltriaminodiphenyl-α-naphthyl-carbinol disulphonic acid anhydride. No. 733 (562)	*Fast Acid Blue* B (By)— A violet powder. In water: λ = 617.1. H_2O: bluish-violet solution. HCl: blue solution. NaOH: blue precipitate. H_2SO_4: brown solution; blue solution on dilution. *Intensive Blue* (By)— A brown powder. In water: λ = 617.1. H_2O: blue solution. HCl: blue solution. NaOH: redder solution. H_2SO_4: brown solution; dark brown solution and then light reddish-blue solution on dilution. Dyes wool from an acid bath level reddish-blue, fast to alkalies and washing, but not very fast to light. Light: 4.
New Patent Blue B, 4B, G, (*By*) Sodium salt of tetramethyldiamino-diphenyl-β-naphthyl-carbinol-disulphonic acid anhydride. No. 734 (563)	*New Patent Blue* 4B (By)— A blue powder. In water: λ = 618.0; *New Patent Blue* B: λ = 624.5. H_2O: blue solution. Amyl alcohol: sparingly soluble. HCl to aqueous solution: yellowish-green solution; brown solution with excess. NaOH: bluish-green solution cold; reddish-violet solution hot. H_2SO_4: brownish-yellow solution; brown solution, green solution and then blue solution on dilution. Dyes wool and silk from an acid bath, pure blue of moderately good fastness to light, milling, acids, alkalies and washing. Light: 3–4.
Erio Green B, extra, (Gy) (Gy) Xylene Fast Green	A brown powder. In water: *Naphthalene Green* V: λ = 641.1; *Erio Green* extra: λ = 643.1. H_2O: bluish-green solution.

B (S) Naphthalene Green V NV, (SCI) (MLB) (CN) Naphthalene Acid Green V (K) Sodium salt of tetra-ethyldiamino-diphenyl-α-naphthyl-carbinol disulphonic acid anhydride. No. 735 (564) **Note:** There are no methyl derivatives manufactured.	Alcohol: green solution. HCl to aqueous solution: brown solution. NaOH: unaltered cold, decolorised hot. H_2SO_4: yellowish-brown solution; yellow solution on dilution. Dyes wool and silk green from an acid bath. Level-dyeing 1–2; relation to cotton, 1–2; relation to silk, 3–4. Light: 3. **One of the best pure greens.**
Wool blue G, extra (A) Acid blue B (S) *No.* 736 (565)	In water: λ = 628.8 and 577.0. H_2O: blue solution. Alcohol: blue solution. HCl to aqueous solution: blue precipitate, soluble in excess to form a green solution, or with a large excess to form a reddish-brown solution. NaOH: unaltered cold, violet solution hot. H_2SO_4: reddish-brown solution; bluish-green solution on dilution. Dyes wool from an acid bath blue, fast to alkalies, stoving, dry-steaming and washing, but of low fastness to light. (4–5.)
Wool Green S, BS, BS extra, C, (CCC) (NAC) (Gy) (S) (SCI) (B) (GCC) (By) (By) (K) Pontacyl Green S extra (DuP) Sodium salt of tetra-methyldiamino-diphenyl-α-hydroxy-naphthyl-carbinoldisulphonic acid anhydride.	A brownish-violet powder with a faint coppery lustre. In water: λ = 634.1. H_2O: greenish-blue solution. Alcohol: greenish-blue solution. HCl to aqueous solution: brownish-yellow solution or brown precipitate. NaOH: rather bluer solution cold, violet solution and then pink solution on heating. H_2SO_4: brownish-violet solution; brown solution and then yellowish-green solution on dilution. Dyes wool and silk from an acid bath sea-green. Level-dyeing, 1; relation to cotton, 1; relation to silk, 3–4. Light: 3–4. Used for compound shades in dyeing woollen piece-goods. Very important.

No. 737 (566) Note: The methyl derivative only is manufactured (see 735).		
Chrome Blue paste (*By*) Tetramethyldiamino-diphenyl-α-hydroxy-naphthycarbinol carboxylic acid anhydride. No. 738 (567)	A brown paste. λ = 618.3. H_2O: partially soluble with a blue colour. Alcohol: sparingly soluble with a blue colour. HCl to aqueous solution: reddish-brown solution. NaOH: scarcely altered. H_2SO_4: dark Bordeaux red solution; reddish-brown solution on dilution. Dyes chrome-mordanted wool blue, moderately fast to washing and milling, but not fast to light. (5–4.) Used in calico and silk printing with a chromium mordant.	

XANTHENES

Pyronine G (*MC*) (*BY*) (*L*) Tetramethyldiamino-xanthonium chloride, or tetramethyldiamino-xanthenyl chloride. *No.* 739 (568)	Glistening green crystals. In water: λ = 548.3 and 509.6. H_2O: red solution with a yellow fluorescence. Alcohol: red solution with a yellow fluorescence. HCl to aqueous solution: bright orange solution with excess. NaOH: pale red precipitate of the colour-base, which dissolves in alcohol or acetone forming red solutions with a yellow fluorescence, and dissolves in benzene forming a red solution without fluorescence. H_2SO_4: reddish-yellow solution; red solution on dilution. Dyes cotton mordanted with tannin and tartar emetic brilliant crimson-red, moderately fast to light and soap. Silk is dyed from a neutral soap bath, but the dye is unsuitable for dyeing wool. Indicator for special work.	
Acridine Red 3B (*MC*) (*L*) Dimethyldiamino-xanthenyl chloride. No. 740 (569)	A brown powder. In water Acridine Red B: λ = 548.7 and 544.7. H_2O: red solution with a greenish-yellow fluorescence. HCl to aqueous solution: orange solution with excess. NaOH: reddish precipitate. H_2SO_4: yellow solution with a green fluorescence; orange solution and then red solution on dilution. Dyes cotton mordanted with tannin and tartar emetic and silk from an acidified soap bath reddish-pink, yellower	

	than Pyronine G (No. 739), fast to washing and moderately fast to light. Wool is dyed from a neutral or faintly acid bath. Light: 4. No longer manufactured.
Pyronine B *(MC) (By) (L)* Tetraethyldiamino-xanthenyl chloride. No. 741	The properties are similar to those of Pyronine G (No. 739), except for a redder fluorescence and a bluer shade. No longer manufactured.
Urbine E Probably a dye of the *Pyronine type.* No. 742	Glistening green needles. H_2O: cherry-red solution with a yellowish-orange fluorescence. Alcohol: cherry-red solution with a yellowish-orange fluorescence. Dyes silk and wool from a neutral bath, or from a bath rendered faintly acid with acetic acid, red, and cotton, mordanted with tannin and tartar emetic, duller and bluer shades.
Rhodamine S, S extra, **(SCI) (B) (By) (K)** Zinc double chloride of dimethyl-*m*-amino-phenol-succinein, or of tetramethyldiamino-carboxy-ethyl-xanthenyl. No. 743 (570)	Dark green crystalline powder or large crystals. In water: $\lambda = 545.1$ and 509.0. H_2O: readily soluble with a red colour and a yellow flourescence; the latter disappears on heating. Alcohol: sparingly soluble with an intense yellow fluorescence. HCl to aqueous solution: yellower solution. NaOH: slowly decolorised and the colour-base is precipitated. H_2SO_4: brownish-yellow solution with a strong green fluorescence; rose-red solution on dilution. Dyes unmordanted cotton, or cotton mordanted with tannin and aluminium acetate, pink. Light: 3. Used also for dyeing half-silk and for colouring paper-pulp and wood.
Saccharein *(Mo)* No longer upon the market. Hydrochloride of diethyl-*m*-amino-phenol-saccharein, or tetraethyl-diamino-*o*-sulphoamino-phenyl-xanthenyl chloride. *No.* 744	Glistening green metallic crystals. H_2O: reddish-violet solution. Alcohol: reddish-violet solution. HCl to aqueous solution: unaltered with dilute acid, brown solution with concentrated acid. NaOH: decolorised, with precipitation of the colour-base which after crystallisation from petroleum spirit melts at 240–245°. Dyes wool and silk from a neutral bath rather bluer shades than the Rhodamines, but not of commercial value as it is decolorised by alkalies. Light: 4–3.
Rosamine *Benzorhodamine* Tetramethyldiamino-phenyl-xanthenyl	Hydrochloride: blackish-red needles with a steel-blue reflex; oxalate: dark green needles; nitrate: steel-blue needles.

chloride No. 745	H_2O: readily soluble, with a bluish-red colour and a bright yellowish-red fluorescence. Alcohol: readily soluble, with a bluish-red colour and a bright yellowish-red fluorescence. NaOH: bluer and less fluorescent solution; the colour-base is precipitated on long keeping. H_2SO_4: orange-yellow solution; red solution on dilution. HNO_3: *id.* Dyes wool and silk from a faintly acid bath pink to dark bluish-red with a yellowish-red fluorescence, and cotton, mordanted with tannin and tartar emetic, a bluer shade. Not on the market.
Rhodamine 5G (*By*) Dimethyldiamino-dimethyl-*o*-chloro-phenyl-xanthenyl chloride. No. 746	A reddish-brown powder. H_2O: red solution with a yellow fluorescence. λ = 531.2 and 495.3. Alcohol: red solution with a yellow fluorescence. H_2SO_4: yellow solution, red precipitate on dilution. Dyes silk, and cotton mordanted with tannin and tartar emetic, brilliant red, to pink, similar to Rhodamine 6G (No. 752). Scarcely used. Light: 3.
Sulphureïn (*Mo*) No longer upon the market. Tetraethyldiamino-*o*-sulpho-phenyl-xanthenyl sulphate. No. 747	A glistening green metallic powder. H_2O: bluish-red solution with a yellowish-red fluorescence. Alcohol: bluish-red solution with a strong yellowish-red fluorescence. HCl to aqueous solution: unaltered with dilute acid, brown solution with concentrated acid. NaOH: diminution of the fluorescence. H_2SO_4: yellowish-red solution; bluish-red solution on dilution. HNO_3: *id.* (decomposition). Dyes wool and silk from a neutral bath bluish-red, fast to alkalies.
Xylene Red B (S) Sulpho Rhodamine B (MLB) Sulpho Rosazine B, B extra (MLB) Sodium salt of tetra-ethyldiamino-sulpho-phenyl-xanthenyl sulphonate. No. 748 (579)	A brownish-red powder. In water: λ = 566.5 and 525.4. H_2O: bluish-red solution. Alcohol: bluish-red solution with a yellow fluorescence. HCl to aqueous solution: orange-red solution. NaOH bluish-red solution. H_2SO_4: orange: solution; red solution on dilution. Dyes wool from an acid bath, level bluish-red, fast to alkalies and of good fastness to washing, stoving and carbonising. Cotton effects are scarcely stained from a sulphuric acid bath. Light: 3–2. Used also in printing wool.

Rhodamine B, B, B extra, B base, NB extra, EB extra conc., O. (CAC) (Gy) (H) (DuP) (S) (SCI) (LJ) (StD) (A) (B) (By) (C) (GrR) (K) (MLB) (DuP) (CN) (JDC) (MLB) Hydrochloride of diethyl-*m*-aminophenol-phthalein, or tetraethyldiamino-*o*-carboxy-phenylxanthenyl chloride. No. 749 (573)	Green crystals or reddish-violet powder. In water: λ = 555.0 and 517.0. H_2O: bluish-red solution with a strong fluorescence when dilute. Alcohol: bluish-red solution with a strong fluorescence when dilute; the latter disappears on heating, but returns on cooling. HCl to aqueous solution: gradual separation of green crystals of the hydrochloride, soluble in excess, with a scarlet-red colour. This solution becomes bluish-red on dilution with water. NaOH: a small quantity produces little change in the cold; an excess on heating gives a rose-red flocculent precipitate, soluble in ether or benzene to form a colourless solution; an odour of dimethylamine is observed on heating with concentrated sodium hydroxide. H_2SO_4: yellowish-brown solution with a strong green fluorescence and evolution of hydrochloric acid; scarlet-red solution and then bluish-red solution on dilution. Dyes wool and silk: from a neutral bath strongly fluorescent bluish-red. Level-dyeing, 1; relation to cotton, 4; relation to silk, 5. Dyes cotton, mordanted with tannin and tartar emetic, bluish-pink without fluorescence, or oiled cotton bluish-pink with fluorescence. Light: 3–4. *A Silk-Dye.* Used largely in dyeing paper and matches. Very important.
Rhodamine G, G extra, (S) (SCI) (B) (K) (MLB) Mainly triethyl-diamino-*o*-carboxy-phenyl-xanthenyl chloride. No. 750 (572)	Glistening green crystals. In water: λ = 554.1 and 516.8. H_2O: reddish-violet solution with a vermilion fluorescence. Alcohol: reddish-violet solution with a vermilion fluorescence. HCl to aqueous solution: yellow solution which becomes red on dilution with water. NaOH: unaltered cold, decolorised on heating, with precipitation of the colour-base. H_2SO_4: pale yellow solution; red fluorescent solution on dilution. Dyes wool and silk, from a neutral bath fluorescent red, yellower than Rhodamine B (No. 749). Level-dyeing, 1; relation to cotton, 4; relation to silk, 5. Dyes cotton, mordanted with tannin and tartar emetic, red without fluorescence.

Rhodamine 2B, 3B, 3B extra. (SCI) (SCI) (B) Ethyl-ester of tetra-ethyldiamino-*o*-carboxy-phenyl-xanthenyl-chloride. No. 751 (574)	A brownish-red bronzy powder. In water: λ = 559.2 and 519.7. H_2O: violet-red solution with a brownish-red fluorescence when in very dilute solution. Alcohol: red solution with a vermilion fluorescence. HCl to aqueous solution: yellow solution; red solution on dilution with water. NaOH: unaltered in the cold, but hydrolysed on heating, with precipitation of the colour-base of Rhodamine B. H_2SO_4: greenish-yellow solution; red solution on dilution. HNO_3: *id.* Dyes wool and cotton mordanted with tannin and tartar emetic red, bluer than Rhodamine B (No. 749), silk red with a yellowish-red fluorescence and unmordanted cotton reddish-violet. Light: 3–4. Used mainly for dyeing silk.	
Rhodamine 6G, 6G extra, (CAC) (H) (DuP) (Gy) (S) (SCI) (B) (C) (K) (MLB) (H) (DuP) (S) (SCI) (B) (C) (MLB) Ethyl-ester of di-ethyl-diamino-*o*-carboxy-phenyl-xanthenyl chloride. No. 752 (571)	A vermilion, yellowish-brown or red powder. In water: λ = 525.4 and 491.3. H_2O: readily soluble with a scarlet-red colour and a greenish fluorescence. Alcohol: red solution with a yellow fluorescence. HCl to aqueous solution: red precipitate if concentrated, or small needles crystallise when greatly diluted. NaOH: red precipitate of the colour-base, soluble in benzene with a yellowish-brown fluorescence. H_2SO_4: yellow solution; red solution on dilution. Dyes silk, and cotton, mordanted with tannin and tartar emetic, brilliant red to pink, yellower than Rhodamine G (No. 750), and acetyl-silk pink with a marked yellow fluorescence. **The most beautiful of all artificial dyes.** Indispensable for calico printing. (U. S. A., Russia.)	
Rhodamine 3G, 3G extra, (SCI) (B) Ethyl-ester of amino-methyl-dimethyl-amino-*o*-carboxy-phenyl-xanthenyl chloride. No. 753 (576)	A green crystalline powder. In water: λ = 535.3 and 498.8. H_2O: crimson-red solution with a brown fluorescence. Alcohol: scarlet-red solution with a green fluorescence. HCl to aqueous solution: unaltered. NaOH: scarlet-red precipitate. H_2SO_4: yellow solution; red solution on dilution. Dyes wool and cotton mordanted with tannin and tartar emetic bright, red, bluer than Rhodamine 6G (No. 752); and silk bright red with a bluish-red fluorescence. Light: 3–4.	

Rhodine BS (*SCI*) Methylene derivative of the ethyl-ester of amino-methyl-di-methyl-amino-*o*-carboxy-phenyl-xanthenyl chloride. No. 754	A reddish-brown powder. H_2O: bluish-red solution. λ = not available. HCl: reddish-brown precipitate. NaOH: reddish-brown precipitate. H_2SO_4: yellowish-brown solution, reddish-brown precipitate on dilution. Dyes cotton mordanted with tannin and tartar emetic bright violet-red. Scarcely used.
Rhodine 2G (*SCI*) Ethyl-ester of dimethydiamino-*o*-carboxy-phenyl-xanthenylchloride. No. 755 (577)	A green crystalline powder. H_2O: crimson-red solution. λ = about 540.0. Alcohol: scarlet-red solution with a green fluorescence. HCl to aqueous solution: unaltered. NaOH: scarlet-red precipitate. H_2SO_4: yellow solution; red solution on dilution. Dyes wool, silk and cotton, mordanted with tannin and tartar emetic, brilliant red. Light: 3–4.
Fast Acid Eosine G (MLB) Fast Acid Phloxine A (MLB) Sodium salt of Rhodamine sulphonic acids. No. 756 (581)	*Fast Acid Eosine* G— A vermilion powder. In water: λ = 523.1 and 487.1; *Fast Acid Phloxine* A: λ = 535.3 and 497.0. H_2O: yellowish-red solution with a strong green fluorescence. HCl: soluble yellowish-red precipitate. NaOH: dark red solution with a strong dark green fluorescence. H_2SO_4: yellow solution with a faint green fluorescence; reddish-yellow solution and then pink solution with a green fluorescence on dilution. HNO_3: *id.* Dyes wool from an acid bath salmon-red to pink; does not exhaust very well. *Fast Acid Phloxine* A dyes bluer shades of red and pink. Level-dyeing, 1; relation to cotton, 1; relation to silk, 4–3. Light: 3.
Violamine B (CCC) (DuP) (MLB) Fast Acid Violet B (**MLB**) Sodium salt of sulpho-diphenyl-diamino-*o*-carboxy-phenyl-xanthenyl. **No. 757 (580)**	A dark blue-violet or maroon powder In water: *Violamine B* (MLB): λ = 546.5. H_2O: readily soluble with a reddish-violet colour. Alcohol: sparingly soluble with a reddish-violet colour. HCl to aqueous solution: purple precipitate. NaOH: cherry-red solution. H_2SO_4: reddish-orange solution; violet solution and then reddish-violet precipitate on dilution. HNO_3: *id.* Dyes wool and silk reddish-violet from and acid bath, or from a neutral bath. Level-dyeing, 2; relation to cotton, 3–4; relation to silk, 4. **Light: 1–2** (**not** 2–3).

	Used largely for dyeing wool and silk; also for tinting and colouring paper. Remarkably **fast to light** when pure.	
Violamine R, RR, (CCC)(DuP) (DuP) Erio Fast Fuchsine BL (Gy) Fast Acid Violet 3RL, A2R, R. (K) (MLB) Sodium salt of sulpho-di-*o*-tolyldiamino-*o*-carboxy-phenyl-xanthenyl. No. 758 (582)	A violet-red powder. In water: *Violamine R* (MLB): λ = 533.9. H_2O: readily soluble with a violet-red colour. Alcohol: violet solution. HCl to aqueous solution: bluish-red precipitate. NaOH: unaltered. H_2SO_4: yellowish-red solution; bluish-red solution and then bluish-red precipitate on dilution. HNO_3: *id.* Dyes wool and silk reddish-violet from an acid bath, or from a neutral bath, or chrome-mordanted wool. Level-dyeing 2; relation to cotton, 3–4; relation to silk, 4. Light: 1–2. Used largely for dyeing wool and silk; also for fast compound shades in conjunction with acid chrome colours; also for tinting and colouring paper. **Very fast to light.**	
Acid Rosamine A (MLB) Violamine G (MLB) Sodium salt of sulpho-dimesidyldiamino-*o*-carboxy-phenyl-xanthenyl. No. 759 (583)	A light red powder. In water: λ = 525.3. H_2O: yellowish-pink solution. Alcohol: sparingly soluble. HCl to aqueous solution: red flocculent precipitate. NaOH: yellower solution and yellow precipitate. H_2SO_4: brownish-yellow solution; redder solution and then red precipitate on dilution. HNO_3: brown. Dyes silk and wool brilliant reddish-pink from an acid bath, or from a neutral bath. Light: 2. Level-dyeing, 4–3; relation to cotton, 3; relation to silk, 4.	
Fast Acid Blue R. R conc. (MLB) Violamine 3B (MLB) Sodium salt of sulpho-diethoxydiphenyl-diamino-*o*-carboxydichloro-phenyl-xanthenyl. No. 760 (584)	A dark bluish-violet powder. In water: *Fast Acid Blue* R: λ 533.9. H_2O: readily soluble with a dark blue colour. Alcohol: sparingly soluble with a dark blue colour. HCl to aqueous solution: blue precipitate. NaOH: violet solution; redder solution on heating; *R conc.*, violet precipitate. H_2SO_4: dark Bordeaux red solution, blue precipitate on dilution. HNO_3: black-blue. Dyes wool and silk blue from an acid bath. Level-dyeing, 4; relation to cotton, 3; relation to silk, 4. Light: 2. **The bluest of the Violamines.**	
Rhodamine 12 *GM*, (*SCI*)	A reddish-brown powder. In water: λ = 525.8, 488.5 and 457.8.	

Ethyl-ester of methoxy-dimethyl-amino-*o*-carboxy-phenyl-xanthenyl chloride. No. 761 (575)	H_2O: yellowish-red solution. Alcohol: yellowish-red solution. HCl to aqueous solution: unaltered. NaOH: light red precipitate. H_2SO_4: yellow solution; yellowish-red solution on dilution. Dyes silk, and cotton, mordanted with tannin and tartar emetic, yellowish-red. Light: 3–4.
Chromorhodine B (*DH*) Sodium salt of sulpho-oxydimethyl-amino-*o*-carboxy-phenyl-xanthenyl-, or of sulpho-dimethyl-amino-*o*-carboxy-phenyl-fluorone. No. 762	A bluish-red powder. H_2O: cherry-red solution with a strong yellow fluorescence. λ = ca. 500.0. HCl: the fluorescence disappears. NaOH: slightly bluer solution. H_2SO_4: lemon-yellow solution with a green fluorescence; orange-red solution and then pink solution on dilution. Dyes chrome-mordanted wool or chrome-mordanted cotton red. Used mainly in calico printing with chromium acetate. Little used.
Rhodamine 12GF, 12G extra (*SCI*) Components— Dimethylamino-*m*-hydroxybenzoyl-benzoic acid (from Dimethyl-*m*-amino-phenol and Phthalic anhydride) and Resorcinol, Methylate, and Formaldehyde. No. 763 (578)	A light red powder. In water: λ = 526.7, 489.2 and 458.4. H_2O: yellowish-red solution. Alcohol: yellowish-red solution. HCl to aqueous solution: unaltered. NaOH: light red precipitate. H_2SO_4: yellow solution; yellowish-red solution on dilution. Dyes silk, and cotton, mordanted with tannin and tartar emetic, brilliant yellowish-red, yellower than Rhodamine 12GM (No. 761). Used mainly in calico and silk printing.
Phenolphthaleïn * Lactone of dihydroxy-triphenyl-carbinol carboxylic acid, or pp′-dihydroxydi-phenylphthalide, or dihydroxyphthalo-phenone. No. 764	A white powder, M. P. 253–255°C. H_2O: insoluble. Alcohol: colourless solution. NaOH: red solution; decolorised by the addition of alcohol or an excess of sodium hydroxide. HCl to alkaline solution: decolourised. H_2SO_4: yellowish-solution, white precipitate on dilution. Used in alkalimetry as an indicator which, like litmus, is sensitive to carbonic acid. pH 1.2– 2.8 = Thymol-phthalein 3.0– 4.6 = Bromo-phenol-phthalein 4.4– 6.0 = (Methyl red s.) 5.4– 7.0 = Bromo-cresol-phthalein 6.0– 7.6 = Bromo-thymol-phthalein 6.6– 8.2 = Phenol-red

* Derivatives of Phenolphthalein are used for exact titration work.

	8.2–10.0 = Thymol blue (alkaline phase. See Clark (*loc. cit.*) under Methyl Red.	
Aurotine (*CAC*) Sodium salt of hydroxy-tetranitro-*o*-carboxy-fuchsone. No. 765	An orange-yellow powder. H_2O: dark yellow solution, which, when treated with sodium stannite in presence of an excess of sodium hydroxide, rapidly changes to deep indigo-blue. Alcohol: dark yellow solution. HCl to aqueous solution: precipitate of tetranitrophenolphthalein, M. P. 244°. NaOH: unaltered. H_2SO_4: brownish-orange solution, orange precipitate on dilution. Dyes wool from an acetic acid bath, or chrome-mordanted wool, orange-yellow, which is moderately fast in the latter case. Not used.	
Fluoresceïn O, S, NS, (BDC) (WSS) (StD) (C)(L)(KBH)(DH) (CN) Uranine (BSS) (WSS) (HM) (Sch) (S) (A) (B) (CJ) (L) (MLB) (tM) A mixture of dihydroxy-fluoran with hydroxy-*o*-carboxy-phenyl-fluorone. Uranine— Sodium or potassium salt of hydroxy-*o*-carboxy-phenyl-fluorone. No. 766 (585)	*Uranine*— A yellowish-brown powder. In water: λ = 452.4, 483, 1 and 428.45. H_2O: yellow solution with an intensely green fluorescence which is visible in extreme dilution, for 1 part of Fluoresceïn is sufficient to impart a distinct fluorescence to 40 million parts of water. Alcohol: readily soluble. HCl to aqueous solution: yellow precipitate of the free colour-acid. NaOH: darker solution with a dark green fluorescence. H_2SO_4: yellow solution with a very faint fluorescence; yellow solution and then yellow precipitate on dilution. Dyes wool, and silk from an acid bath yellow with a greenish fluorescence, but not sufficiently fast to be of importance in dyeing. Light: 5. Used mainly for the production of the Eosine dyes; also to a limited extent in printing wool; also for tracing the course of rivers and for testing the source of contamination of wells. A subcutaneous injection of an alkaline solution of Fluoresceïn is the most reliable method for diagnosis of death, for a still living human body acquires a yellowish-green coloration within a few minutes.	
Chrysoline (LBH) (S) (Mo) (*StD*) Probably the sodium salt of hydroxy-	A reddish-brown powder or glistening green lumps with an odour of benzyl chloride. In water: λ = 488.5 and 455.9.	

benzyl-*o*-carboxy-phenyl-fluorone. No. 767 (586)	H_2O: brown solution with a green fluorescence. HCl: brownish-yellow precipitate. NaOH: darker solution. H_2SO_4: yellow solution, brownish-yellow precipitate on dilution. Dyes silk from a neutral bath, or preferably with the addition of alum, yellow, moderately fast to light, the shade is similar to that of Turmeric. Light: 4–5. Used to a limited extent in cotton dyeing for topping Quercitron Yellow.
Eosine YS, yellowish, A, 3G, (BDC) (WSS) (BSS) (A) (K) (LBH) Eosine, Y extra, DWC (No, 73, No. 1 yellowish, K Sord., N D A, J J F, J extra, 3J, MP, G, I yellowish, S extra yellowish, GGF, 4J extra, OO extra, extra water-soluble, G extra. 2G. (HM) (StD) (B) (CJ) (Sch) (DH) (Gy) (S) (CN) (MLy) (Mo) (FB) (Mo) (L) (A) (B) (By) (By) (C) (L) (MLB) (tM) (tM) Sodium or potassium salt of tetra-bromo-fluoresceïn, or of hydroxy-tetra-bromo-*o*-carboxy-phenyl-fluorone. No. 768 (587)	Small red crystals with a bluish reflex, or brownish-red powder. In water: *Eosine 3J* (L): $\lambda = 516.3$ and 483.5. H_2O: soluble in 3 parts, with a bluish-red colour; the diluted solution has a green fluorescence. Alcohol: bluish-red solution with a yellowish-green fluorescence. HCl to aqueous solution: yellowish-red precipitate of the colour-acid, soluble in alcohol with a reddish-yellow colour and no fluorescence. NaOH: darker solution and yellowish-red precipitate cold, or decomposed hot. H_2SO_4: yellow solution, yellowish-red precipitate on dilution. Dyes wool and silk red from an acid bath, in the latter case with a yellowish-red fluorescence. No affinity on silk with Sn + SiO_2. Level-dyeing 4; relation to cotton, 1; relation to silk, 4. Light: 4–5. Dyes cotton, from a lukewarm salt bath, or on a Turkey-red mordant at 40–50°, or on a sodium stannate and alum mordant at 40–50°, red. The material is not rinsed after dyeing and, consequently, Eosine is used for dyeing cotton yarns and piece-goods only when little fastness is required. In calico printing Eosine is fastest when applied as a steam chrome colour, although it is used also as an albumin colour. Used also for the preparation of lakes, *e. g.* Geranium lakes, in combination with red lead, as an imitation Vermilion; also as a self-colour in printing half-silk; also in printing and dyeing jute; also for dyeing straw, coconut fibre, paper, moss, &c.; also for the preparation of orthochromatic photographic plates, the sensitiveness being confined to the yellow and green.

	Eosine YS is used largely for the preparation of red writing and stamping inks. Very little used for textiles.	
Spirit Primrose (DH) **Methyl Eosine** B extra, J extra, (CSI) (Mo) Potassium salt of the methyl-ester of tetrabromofluorescein, or of the methyl-ester- of hydroxy-tetrabromo-*o*-carboxy-phenyl-fluorone. No. 769 (588)	Dark red leaflets or bluish-red powder. H_2O: sparingly soluble cold, more readily soluble with a cherry-red colour on boiling. $\lambda = 519.7$ and [485.5.] Alcohol: red solution with a brownish-yellow fluorescence, but insoluble in absolute alcohol. HCl to aqueous solution: brownish-yellow precipitate. NaOH: darker solution with a green fluorescence. H_2SO_4: yellow solution which evolves bromine on heating, brownish-yellow precipitate on dilution. Dyes silk bluish-red with a brick-red fluorescence, brighter and bluer than Eosine (No. 768). Light: 4. Used also for the preparation of spirit varnishes for colouring tinsel, &c.	
Ethyl Eosine (BDC) Eosine S. spirit-soluble (MLB) (B) Potassium salt of the ethyl-ester of tetrabromofluoresceïn, or of the ethyl-ester of hydroxy-tetrabromo-*o*-carboxy-phenyl-fluorone. No. 770 (589)	A brown powder mixed with small green crystals. In water: *Eosine spirit-soluble* (MLB): $\lambda = 523.1$ and 487.2. H_2O: very sparingly soluble cold, more readily soluble, with a cherry-red colour and faint greenish-yellow fluorescence on boiling. Alcohol: slightly soluble with a red colour and a brownish-yellow fluorescence. HCl to aqueous solution: yellowish-brown precipitate. NaOH: brownish-yellow precipitate. H_2SO_4: yellow solution which evolves bromine on heating, brownish-yellow precipitate on dilution. Dyes silk yellowish-red with a faint fluorescence, bluer than Methyl Eosine (No. 769). Light: 4-3. Used also for the preparation of spirit varnishes for colouring tinsel, &c.	
Eosine BS, BA, BW, DHV, BN, I bluish, S extra bluish, B. (BDC) (LBH) (DuP) (DH) (B) (By) (L) (tM) Eosine Scarlet B, (LBH) (tM) (MLy) (C) Potassium or sodium	A brown crystalline powder. In water: *Eosine BN* (B): $\lambda = 519.9$ and 485.7. H_2O: yellowish-red solution; the diluted solution has a faint green fluorescence. HCl: greenish-yellow flocculent precipitate. NaOH: unaltered. H_2SO_4: brownish-yellow solution which evolves bromine on heating. brownish-yellow precipitate on dilution. Dyes wool and silk from an acetic acid bath bluish-red, not so bright as Methyl Eosine (No. 769), but faster to light and milling than most of the other Eosines. Light: 3-4.	

salt of dibromo-dinitrofluorescein, or of hydroxy-dibromo-dinitro-*o*-carboxy-phenylfluorone. No. 771 (590)		
Erythrosine B, R, G, extra yellowish, yellowish, extra yellow N, (BDC) (AAP) (S) (CJ) (StD) (LBH) (SCI) (B) (L) (B) (C) (MLB) Sodium, potassium or ammonium salt of di-iodofluorescein, or of hydroxy-di-iodo-*o*-carboxy-phenyl-fluorone. No. 772 (591)	A yellowish-brown powder. In water: *Pyrosine J* (Mo): $\lambda = 479.5$ and 512.5. H_2O: cherry-red solution without fluorescence. HCl: brownish-yellow precipitate. NaOH: soluble red precipitate. H_2SO_4: brownish-yellow solution which evolves iodine on heating, brownish-yellow precipitate on dilution. Dyes cotton from a luke-warm salt bath, wool from an acetic acid bath containing alum, and silk from a soap bath yellowish-red with a yellowish-red fluorescence. Light: 4.	
Erythrosine 3B, B, TB, ALP, extra bluish, D, J extra, JNV, W extra, A, B extra pure, extra. (BDC) (HM) (LBH) (WSS) (DuP) (SCI) (A) (C) (CJ) (DH) (B) (CJ) (tM) (MLy) (C) (MO) (MLB) Sodium, or potassium salt of tetra-iodo-fluorescein, or of hydroxytetraiodo-*o*-carboxy-phenyl-fluorone. No. 773 (592)	A brown powder. In water: *Erythrosine D* (C): $\lambda = 526.0$ and 490.5. H_2O: cherry-red solution without fluorescence. HCl: brownish-yellow precipitate. NaOH: soluble red precipitate. H_2SO_4: brownish-yellow solution which evolves iodine on heating, brownish-yellow precipitate on dilution. Dyes wool from an acetic acid bath, or cotton mordanted with alumina, or cotton from a lukewarm salt bath, or silk from a soap bath bluish-red. It is one of the most fugitive dyes to light, and cotton when dyed by either method is not fast to washing. Level-dyeing 4–5; relation to cotton 1; relation to silk 4. Used also for colouring paper and as a colour sensitiser in photography. A mixture of Eosine (No. 768) and Rose Bengale (No. 777) is used to produce a similar shade in dyeing, but cannot be used as a substitute for photographic purposes. Light: 5–4. Officially permitted for colouring food-stuffs in Australia and the United States.	

Phloxine B, P, (iodine free) (BDC) (LBH) (DH) (C) (MLB) (DuP) (B) (B) Erythrosine B extra, BB, (SCI) (A) (CJ) Potassium salt of tetrabromo-dichloro-fluoresceïn, or of hydroxy-tetrabromo-dichloro-*o*-carboxy-phenyl-fluorone. No. 774 (593)	A brownish-yellow powder. In water: λ = 535.7 and 497.15. H_2O: cherry-red solution with a greenish-yellow fluorescence. HCl: brownish-yellow precipitate on warming. NaOH: bluish-red solution. H_2SO_4: brownish-yellow solution unaltered on heating, brownish-yellow precipitate on dilution. Dyes wool from an acetic acid bath bluish-red without fluorescence, bluer than Erythrosine R (No. 772). Level-dyeing, 5–4; relation to cotton, 1; relation to silk, 4. Light: 4.	
Thiophloxine (*Mo*) Probably the potassium salt of the disulphide of hydroxy-dibromo-dichloro-*o*-carboxy-phenylfluorone. No. 775.	A bluish-red powder. H_2O: magenta-red solution without fluorescence. λ = not known. HCl: scarlet-red flocculent precipitate of the colour-acid. NaOH: unaltered. H_2SO_4: orange solution, red flocculent precipitate on dilution. Dyes wool and silk bluish-red from a neutral bath. Not used.	
Cyanosine spirit-soluble (S) (K) (MLB) Potassium or sodium salt of the methyl-ester of tetrabromo-dichloro-fluoresceïn, or of the methyl-ester- of hydroxy-tetrabromo-dichloro-*o*-carboxy-phenyl-fluorone. No. 776 (594)	A brownish-red powder. In water: *Cyanosine spirit-soluble* (MLB): λ = 536.6 and 498.8. H_2O: insoluble cold, slightly soluble on boiling. Alcohol: bluish-red solution with a reddish-yellow fluorescence. HCl to alcoholic solution: the fluorescence disappears. NaOH: unaltered. H_2SO_4: yellow solution which evolves bromine on heating, reddish-brown precipitate on dilution. Dyes silk red from a weak acetic acid bath. Light: 4. Used also for the preparation of spirit varnishes for colouring tinsel, &c.	
Rose Bengale N, AT, NT, NTO, B, G (LBH) (DH) (S) (StD) (A) (B) (R) (tM) (MLy) (C) (A) (B) (B) (CJ) (L) (MLB) Potassium or sodium	A dark red powder. H_2O: readily soluble with a cherry-red colour and no fluorescence. λ for AIa = 551,2; 510.4 λ for AT = 548.0; 507.5 for B(CJ) = 507.0; 547.5 B conc. [M] 551.2; 510.4 3B = 551.2 5BG: 551.2. G: 547.5; 507.0. extra N: 543.8. NT = 548.0; 507.0.	

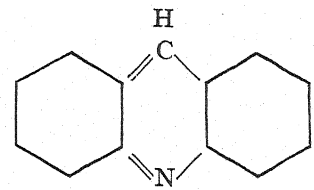
salt of tetra-iodo-dichlorofluoresceïn, or of hydroxy-tetra-iodo-dichloro-*o*-carboxy-phenyl-fluorone. No. 777 (595)	HCl: brownish-red precipitate. NaOH: crimson-red soluble precipitate. H_2SO_4: brownish-yellow solution which evolves iodine on heating, brownish-red precipitate on dilution. Dyes wool from an acetic acid bath, and silk from a soap bath bluish-red with fluorescence, but is little used, as it is too fugitive to light. Level-dyeing, 5–4; relation to cotton, 1; relation to silk, 4. Dyes cotton bluish-red from a salt bath. Used also for dyeing jute, straw, coconut fibre, wood &c.; formerly used for rendering photographic emulsions sensitive to green and yellow light. Light: 5–4.
Phloxine B, P, TA, N, BB, **(BDC) (LBH) (Mo) (CJ)** Sodium salt of tetra-bromo-tetra-chloro-fluoresceïn, or of hydroxy-tetrabromo-tetrachloro-*o*-carboxy-phenylfluorone. No. 778 (596)	A brick-red powder. In water: *Eosine blue* (S), *Cyanosine* (DH), *Eosine* 10B (C): λ = 539.5 and 500.8. H_2O: readily soluble, with a bluish-red colour and a faint dark green fluorescence. Alcohol: bluish-red solution with a brick-red fluorescence. HCl to aqueous solution: decolorised with separation of a reddish-precipitate. NaOH: unaltered. H_2SO_4: yellow solution; yellowish-red precipitate on dilution. Dyes wool and silk red from an acetic acid bath. Level-dyeing, 5–4; relation to cotton, 1; relation to silk, 4. Light: 4–5. Dyes cotton red from a salt bath.
Rose Bengale **extra, 3B, conc.,** **N extra, B, 2B,** (DuP) (HM) (S) (B) (C) (DH) (DH) (MLB) (CN) (B) (K) (L) (MLB) (CJ) Potassium salt of tetra-iodo-tetrachlorofluoresceïn, or of hydroxy-tetraiodo-tetrachloro-*o*-carboxy-phenylfluorone. No. 779 (597)	A brownish-red powder. In water: λ = 550.7 and 512.5. H_2O: bluish-red solution without fluorescence. HCl: flesh-pink flocculent precipitate. NaOH: unaltered. H_2SO_4: brown solution, flesh-pink precipitate on dilution. Dyes wool and silk bluish-red from an acetic acid bath. Level-dyeing, 5; relation to cotton, 1; relation to silk, 4. Light: 5–4. Dyes cotton bluish-red from a salt bath.
Cyanosine B, (*BDC*) (*SCI*) Sodium salt of the ethyl-ester of tetra-bromo-tetrachloro-fluoresceïn, or of the ethyl-ester- of hydroxy-tetrabromo-tetrachloro-*o*-carbox-	A red crystalline powder. H_2O: sparingly soluble with a red colour and a yellow fluorescence. λ = ca. 552.0. HCl: brownish-red flocculent precipitate. NaOH: rather darker coloured solution. H_2SO_4: yellowish-brown solution, brownish-red precipitate on dilution.

yphenylfluorone. No. 780 (598)	Dyes wool bluish-red from a weak acetic acid bath. Used for the preparation of spirit varnishes for colouring tinsel, &c. Light: 4–5.	
Galleïn L pdr. J, (BDC) (DH) Galleïn, paste, paste A, (B Y) (B) (M L B) Pyrogallol-phthaleïn, or dihydroxy-fluorescein, or trihydroxy-*o*-carboxy-phenylfluorone. No. 781 (599)	*Free Acid*— A violet paste, or dark green crystalline powder with a metallic lustre. In water: *Galleïn W powder*: (MLB): λ = 541.5 and 497.0. H_2O: sparingly soluble cold, more readily soluble hot, with a scarlet-red colour. Alcohol: sparingly soluble cold, more readily soluble hot, with a reddish-brown colour. HCl to aqueous solution: yellowish-brown solution. NaOH: blue solution. H_2SO_4: reddish-yellow solution, flocculent reddish-yellow precipitate on dilution. Dyes chrome-mordanted wool cotton or silk, bluish-violet. In silk dyeing the brighter alumina lake, although rather less fast to light, is preferred to the chromium lake. (CrF_3). Light: 3. Relation to cotton, 4; relation to silk, 3. Used also in calico printing.	
Coeruleïn B, BR, BW, paste, BWR pdr. (*MLB*) Probably an anhydride of Fluoresceïn. No. 782 (600)	A black powder. In alcohol: *Coeruleïn B* (MLB): about λ = 582.0 and 540.5. H_2O: red solution. NaOH: greenish-blue solution. HNO_3: green. Dyes wool mordanted with potassium bichromate and tartar, lactic acid or formic acid, green, rather bluer than No. 783; particularly useful for dyeing by the after-chrome process. Relation to cotton, 4; relation to silk, 3. Light: 2–3.	
Coeruleïne L paste, paste, I, II, W paste, paste A, (BDC) (DH) (By) (B) (MLB) Anhydride of Galleïn, or of trihydroxy-*o*-carboxy-phenylfluorone. No. 783 (601)	*Coeruleïne paste*— A black paste. H_2O: insoluble. λ = not sharp. Alcohol: insoluble. HCl to aqueous suspension: unaltered. NaOH: dull green solution. H_2SO_4: dark brown solution, greenish-black precipitate on dilution. *Coeruleïne S*— A black paste or black powder. In water: *Coeruleïne S* (MLB): λ = 603.0. H_2O: sparingly soluble cold, dull greenish-brown solution hot. Alcohol: grenish-blue solution hot. HCl to aqueous solution: evolution of sulphur dioxide on boiling. NaOH: olive-green precipitate. H_2SO_4: dark brown solution and evolution of	

	sulphur dioxide, greenish-black precipitate on dilution. Dyes chrome-mordanted cotton, silk and wool green; the S brands are particularly suitable for use in calico printing. Coeruleïne can also be dyed from the vat, but the shade must be after-chromed (Hoechst Farb. G. P. 252576). Very important for calico printing. Wool relation to cotton 4; relation to silk 3. Light: 2.
Ultraviridine B (S) The anhydride of dimethylamino-hydroxy-*o*-carboxyphenylfluorone. No. 784	A dark green crystalline powder. H_2O: blue solution. Alcohol: blue solution. HCl to aqueous solution: duller blue solution. NaOH: dark green precipitate. H_2SO_4: dark brown solution; olive solution and then blue solution on dilution. Dyes chrome-mordanted wool and cotton dark green, fast to light and washing; the tannin lake is dark blue. Light: 3. Used in calico printing.

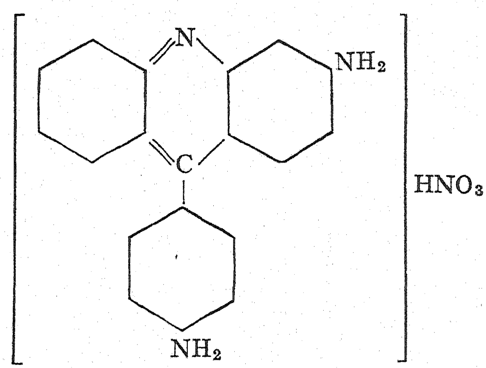
ACRIDINE DYES NO. 785–799

Acridine Colouring Matters are derived from Acridine, a substance which occurs in coal tar, and which can be synthesised by different chemical processes. The formula is:



M. P., 110°, B. P., about 400°; colourless needles having a strong *blue fluorescence which is characteristic for all Acridine Colours.*

The substitution products, *i. e.* the Amino, Methylamino, or Aryl-Amino derivatives of Acridine are strongly coloured, and one of the oldest artificial Dyestuffs, namely Phosphine, having the formula, belongs to this class.



Phosphine is found in the by-products of Magenta and is used to a limited extent for printing rather dull orange-yellow shades on calico. Most of the more important Acridine dyestuffs are used for leather with titanium mordant, giving full yellow to orange shades of good fastness. In recent years Ehrlich, the discoverer of Salvarsan, found that certain N-Alkyl derivatives, *i. e.* Ammonium salts of Acridine, are very powerful disinfectants (Trypaflavine), and a number of similar compounds are now on the market. Bayer 205, however, is more powerful as a remedy against sleeping sickness.

Acridine Yellow GR, 2R, R, G, T, (LBH) (LBH) (MC) (L) **(MC)** (L) Hydrochloride of diamino-dimethyl-acridine or diamino-dimethyl-acridinium chloride. No. 785 (602)	A yellow powder. In water: $\lambda = 455.0$. H_2O: yellow solution with a green fluorescence. Alcohol: yellow solution with a green fluorescence. HCl to aqueous solution: yellow precipitate. NaOH: yellow precipitate. H_2SO_4: light yellow solution, yellow precipitate on dilution. Dyes cotton, mordanted with tannin and tartar emetic, bright pure yellow, and silk greenish-yellow with a green fluorescence. Light: 3–4. Used in colour discharge printing with stannous chloride and hydrosulphite, or for white discharges with chlorate; also for dyeing half-silk, linen and jute.
Auracine G (By) Aurazine G *(By)* Diamino-dimethyl-acridinium formate No. 786	A yellowish-brown powder. H_2O: yellow solution with a green fluorescence. Alcohol: yellow solution with a green fluorescence. HCl to aqueous solution: yellowish-brown flocculent precipitate. NaOH: light yellow, flocculent precipitate. H_2SO_4: yellowish solution with a green fluorescence and evolution of formic acid on warming; reddish-brown solution and then yellowish-brown precipitate on dilution. Dyes silk, and cotton, mordanted with tannin and tartar emetic, yellow, less fast to light, but more resistant, to heat than Auramine (No. 655). The shade is unaffected by the sodium hydroxide used in crimping. Light: 4.
Coriophosphine O *(By)* Probably hydrochloride of amino-dimethylamino-methyl-acridine, or amino-dimethylamino-methyl-acridinium chloride. No. 787	A reddish-brown powder. H_2O: orange-yellow solution with a yellowish-green fluorescence which is increased by the addition of alcohol. Alcohol: orange-yellow solution. HCl to aqueous solution: yellowish-brown solution. NaOH: yellow precipitate and colourless solution. H_2SO_4: light yellowish-brown solution; orange-red solution and then orange-yellow solution on dilution. Dyes leather level yellow and cotton, mordanted with tannin and tartar emetic, bright yellowish-brown. Light: 3.
Acridine Orange E, LP, DH, pdr, N, NO, (BDC) (DH) (CN) **(MC)** (L) Zinc double chloride	An orange-coloured powder. In water: *Acridine Orange NO* (L): λ = 496.25 and 466.90. H_2O: orange-yellow solution with a green fluorescence.

of tetramethyl-diaminoacridine, or of tetra-methyldi-amino-acridinium chloride. No. 788 (603)	Alcohol: orange-yellow solution with a green fluorescence. HCl to aqueous solution: red solution. NaOH: yellow precipitate. H_2SO_4: almost colourless solution with a green fluorescence; red solution and then orange-yellow solution on dilution. Dyes a cotton, mordanted with tannin and tartar emetic, orange, and silk from a soap bath orange with a green fluorescence, moderately fast to light and soap. Light: 3–4. Used also in calico printing and for dyeing leather.	
Acridine Scarlet J pdr. (*DH*) Dibromo-derivative of tetramethyl-di-amino-acridinium chloride. No. 788a	An orange-red solution. Alcohol: orange-red solution, HCl to aqueous solution: orange-red to magenta-red solution. NaOH: yellow precipitate. H_2SO_4: yellow solution with a green fluorescence; magenta-red solution and then orange-red solution on dilution. Dyes cotton, mordanted with tannin and tartar emetic, and leather, scarlet-red, fast to chlorine. Used also for dyeing silk and artificial silk; also in calico printing. Light: 4. Probably mixtures form Pyronine and Acridine Orange (Formanck page 346).	
Brilliant Phosphine G, 3G, 5G, (CAC) (**SCI**) Alkylated Acridine dyes. No. 789.	*Brilliant Phosphine* 5G— A light brown powder. H_2O: yellow solution, with a green fluorescence when dilute. One-sided absorption. Alcohol: yellow solution with a green fluorescence. HCl to aqueous solution: unaltered. NaOH: yellowish-brown precipitate. H_2SO_4: yellow solution with a green fluorescence; brown solution and then yellow solution on dilution. Dyes cotton mordanted with tannin and tartar emetic bright orange-brown. Light: 3. Used mainly for **dyeing leather,** with titanium mordant.	
Acriflavine (BDC) (By) Trypaflavine (C) Diamino-methyl-acridinium chloride. No. 790	H_2O: very soluble, with a yellow colour and a green fluorescence at great dilution. Alcohol: yellow solution, with a strong yellowish-green fluorescence. NaOH: orange precipitate with excess, which dissolves almost completely on heating. H_2SO_4: pale yellow solution with an intense bluish-green fluorescence. Dyes cotton mordanted with tannin and tartar emetic, and leather, pure yellow, fast to soap and soda.	

	Used first for the treatment of **sleeping sickness,** owing to its trypanocidal action, and later as an antiseptic for the treatment of wounds (1:1000–750); its action is more powerful in blood serum than in water and it possesses low toxicity.	
Benzoflavine No. 2 (GrE) (GrE) Hydrochloride of diamino-dimethylphenylacridine or diamino-dimethylphenylacridinium chloride. No. 791 (605)	A brownish-orange powder. H_2O: yellow solution, with a yellowish-green fluorescence. Alcohol: reddish-yellow solution with a strong greenish-yellow fluorescence. HCl to aqueous solution: orange precipitate. NaOH: yellowish-white precipitate. H_2SO_4: greenish-yellow solution with an intense green fluorescence; yellow solution and then orange precipitate on dilution. Dyes cotton direct, or cotton, mordanted with tannin and tartar emetic, yellow. Used mainly in calico printing; also for **dyeing leather;** of little importance for dyeing wool and silk.	
Acridine Orange R, Rextra, (LBH) (MC) (L) Hydrochloride of tetramethyldiaminophenylacridine or tetramethyldiaminophenylacridinium chloride. No. 792 (604)	An orange-red powder. H_2O: orange-yellow solution. Alcohol: orange-yellow solution with a green fluorescence. HCl to aqueous solution: red solution. NaOH: yellow precipitate. H_2SO_4: yellow solution with a green fluorescence; red solution on dilution. Dyes cotton mordanted with tannin and tartar emetic orange. Used with titanium mordant almost exclusively for **Leather.** Light: (leather): 2–1.	
Phosphine Y, R, I, JJ, 3R, E, N, II, A, LB, LR, RX, GO, P, LM, O extra. (BSS) (H) (HM) (MC) (MLy) (A) (B) (C) (GrE) (K) (MLB) (NI) (H) (SCI) (GrE) (StD) (A) (B) (B) (K) (C) (GrE) (K) (MLB) Mixture of the nitrates of Chrysaniline (unsymm. di-	An orange-yellow powder. H_2O: reddish-yellow solution with a green fluorescence. Alcohol: reddish-yellow solution with a green fluorescence. HCl to aqueous solution: brighter solution. NaOH: light yellow precipitate. H_2SO_4: light reddish-yellow solution with a green fluorescence; deep reddish-yellow solution on dilution. Dyes cotton direct, or cotton, mordanted with tannin and tartar emetic, yellowish-brown. Used for dyeing cotton; also in calico printing for shading creams and for yellow discharges with hydrosulphite NF; also for dyeing silk and in printing wool. The principal application, however, is for dyeing leather. Of later years not much used on account of its dull shade. A by-product from Fuchsine.	

aminophenyl-acridine), compounds, particularly Chrysotoluidine, $C_{20}H_{17}N_3$. No. 793 (606)		
Phosphine 2G (K) Flavophosphine G new, GG conc., GG new, GGO new, 4G new, R new, RO **(MLB)** Nitrate of diamino-methyl-phenyl-acridine or diamino-methyl-phenyl-acridinium nitrate. No. 794	*Flavophosphine G new*— A brown powder. H_2O: brownish-orange solution. Alcohol: orange-yellow solution with a strong green fluorescence. HCl to aqueous solution: lighter solution and faint precipitate. NaOH: brownish-yellow flocculent precipitate. H_2SO_4: dark yellowish-brown solution with a strong green fluorescence yellowish-orange solution on dilution. Dyes cotton mordanted with tannin and tartar emetic yellow. *Flavophosphine R new*— A reddish-brown powder. H_2O: reddish-orange solution. Alcohol: orange-yellow solution. HCl to aqueous solution: redder solution. NaOH: orange flocculent precipitate. H_2SO_4: yellow solution with a strong green fluorescence; orange solution on dilution. Dyes cotton, mordanted with tannin and tartar emetic, orange. Light: 3–4. Used in **calico printing** and for **dyeing leather.**	
Rheonine A, AL, G, N, **(B)** Hydrochloride of amino-tetramethyl-diamino-phenyl-acridine or amino-tetramethyl-diamino-phenylacridinium chloride. No. 795 (607)	*Rheonine A* (B)— A brown powder. In water: about $\lambda = 466.90$. H_2O: brownish-yellow solution with a green fluorescence. Alcohol: brownish-yellow solution with a green fluorescence. HCl to aqueous solution: brownish-red solution with an orange-red fluorescence. NaOH: light brown precipitate. H_2SO_4: brown solution with a green fluorescence; brownish-red solution with an orange-red fluorescence on dilution. Dyes cotton, mordanted with tannin and tartar emetic, silk and **leather,** brownish-yellow of good fastness to light, chlorine and washing. Leather with titanium mordant. Used also in calico printing. Discharged by hydrosulphite NF.	
Flaveosine The N-analogue of Rhodamine B (No. 749), tetraethyl-diamino-*o*-carboxy-	Hydrochloride: glistening brownish-yellow needles. Sulphate: glistening cantharides prisms. H_2O: orange solution with a green fluorescence. λ: not available.	

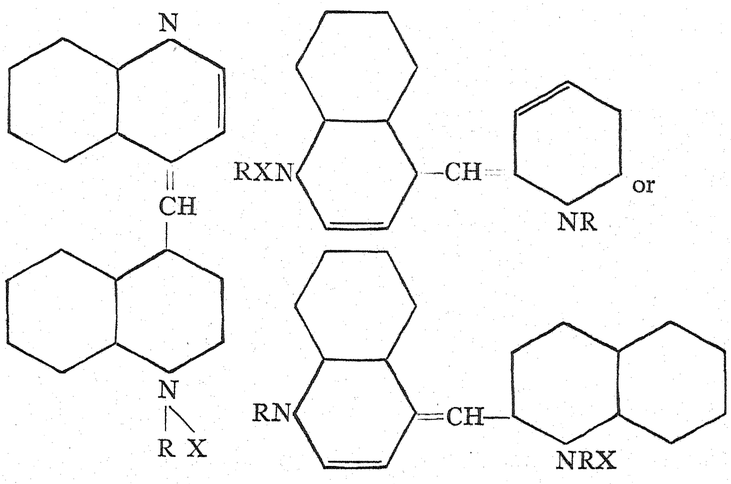
phenylacridinium chloride. No. 796	Alcohol: orange solution with a green fluorescence. HCl to aqueous solution: orange-red solution with a green fluorescence. NaOH: light yellow solution. H_2SO_4: light yellow solution with a bluish-green fluorescence; deep red solution with a faint brown fluorescence, orange solution and then yellowish-orange solution with a green fluorescence on dilution. Dyes silk from an acid bath golden-yellow with a fine greenish-yellow fluorescence, and wool, and cotton, mordanted with tannin and tartar emetic, reddish-yellow. The dyeings possess the same fastness to washing and light as those of Rhodamine B (No. 749).	
Euchrysine 2G, R, RR (B) No. 797 (608)	*Euchrysine 2G*— A reddish-yellow powder. H_2O: yellow solution. λ: one-sided absorption. Alcohol: yellow solution with a green fluorescence. HCl to aqueous solution: reddish-yellow solution. NaOH: light yellow precipitate. H_2SO_4: yellow solution with a strong green fluorescence; reddish-yellow solution on dilution. Dyes cotton, mordanted with tannin and tartar emetic, moderately pure bright yellow, and silk pure greenish-yellow. *Euchrysine RR*— Dyes cotton, mordanted with tannin and tartar emetic, orange-yellow. Light: 3–4. Used mainly for dyeing vegetable-tanned leather; also as a yellow discharge in calico printing.	
Homophosphine G (*L*) No. 798 (609)	A reddish-brown powder. H_2O: brown solution. Alcohol: yellowish-brown solution with a strong green fluorescence. HCl to aqueous solution: rather redder solution: yellow precipitate. H_2SO_4: light red solution with a green fluorescence; red solution on dilution. Dyes cotton, mordanted with tannin and tartar emetic, level vivid brownish-orange. Light: 3–2. Used also for dyeing leather, silk and half-silk; also in calico printing.	
Corioflavine G, GG, GGr, R, RR, (GrE) No. 799	Red or reddish-brown powder. H_2O: orange-brown solution. Alcohol: yellowish-brown solution. HCl to aqueous solution: darker solution. NaOH: orange precipitate. H_2SO_4: yellow solution with a strong green fluorescence; brown solution and	

	then orange-brown solution on dilution.
	Used for dyeing leather; also to a less extent for yellow or orange discharges in calico printing. Light: 3.

QUINOLINE DYES

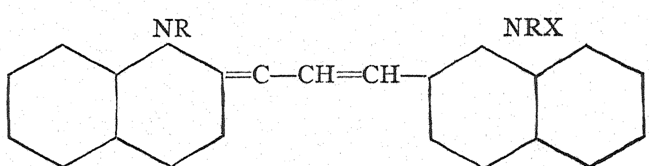
No. 800–811

The Quinoline colouring matters form a class the members of which, with the exception of Quinoline Yellow, are of no importance at all for textile fibres, but these beautiful substances are very important for sensitising photographic plates. The most important compounds are Pinaverdol and Ethyl Red. These Quinoline dyes belong to the Cyanines and the iso-Cyanines, having the general formula:



Cyanines Isocyanines

and



Carbocyanines

These Quinoline dyes, with the exception of Quinoline yellow, are red, pink or blue, and give the most characteristic absorption spectra of the whole class of artificial dyestuffs. I have myself,

[1] The only book which gives good information on this very complicated matter is written by J. T. Hewitt, (*Dyestuffs Derived from Pyridine, Quinoline, Acridine and Xanthene*, London 1922). The best comprehensive publication on the sensitisers is that of W. J. Pope and his collaborators. For their study Hewitt's work can strongly be recommended.

measured the absorption of several of the Cyanines having found no reliable information in the literature of the subject. The absorption bands are very sharp.

Some of the quinoline derivatives have been known for over 70 years, being among the first artificial dyestuffs made in England by Williams, but only in comparatively recent times have the German dyeworks discovered that by changing the substituents very useful products can be obtained, which may be regarded as "indispensable" for photographic work. These dyestuffs are so sensitive towards light that spectroscopic work has to be done very quickly and with quite freshly prepared solutions; otherwise the absorption bands will change and incorrect results will be obtained.

Quinoline Yellow spirit-soluble (H) (S) (RF) (A) (B) (By) (K) A mixture of symm. quinophthalone or 2-quinolylindandione, with small quantities of iso-quinophthalone, or unsymm.-quinophthalone or 2-quinaldylene-phthalide. No. 800 (612)	A yellow powder which crystallises from boiling alcohol in thin golden-yellow needles, M. P. 240°; iso-quinophthalone is more soluble in alcohol and crystallises in orange-yellow prisms, M. P. 187°. Partial absorption in the blue and violet. H_2O: insoluble. Alcohol: sparingly soluble, with a yellow colour. HCl: insoluble. NaOH: insoluble. H_2SO_4: yellowish-red solution, yellow flocculent precipitate on dilution. Dyes melted wax, paraffin oil, spirit varnishes &c., yellow. Light: 3–2. Used for the preparation of Quinoline Yellow water-soluble (No. 801).	
Quinoline Yellow SS, O, (BDC) (NAC) (S) (SCI) (LJ) (RF) (FB) (JDC) (A) (B) (By) (K) (MLB) (B) **(MLB)** Sodium salt of a mixture of the mono- and disulphonic acids (mainly the latter) of quinophthalone, or of 2-quinolylindandione. No. 801 (613)	A yellow powder. H_2O: yellow solution. Alcohol: yellow solution. HCl to aqueous solution: paler and brighter solution. NaOH: darker solution. H_2SO_4: yellowish-red solution; yellow solution on dilution. Quinoline Yellow is not decolorised by reducing agents—distinction from Picric Acid (No. 7) and Naphthol Yellow S (No. 10). Dyes wool and silk greenish-yellow with a green fluorescence from an acid bath. Level-dyeing, 1; relation to cotton, 2; relation to silk, 3–4. Light: 3. Used as a pure level greenish-yellow dye alone or in admixture with Naphthalene Green V (No. 735), Patent Blue V (No. 712), or other level dyes for green shades for dyeing billiard cloths; also in admixture with Fast Acid Eosine G (No. 756), for cream or	

	salmon shades fast to stoving; also in calico printing for coloured discharges with zinc dust, hydrosulphite or stannous chloride; also extensively for dyeing silk and for colouring paper and leather; also for the manufacture of lithographic colours.	
Quinoline Yellow *KT extra* (*By*) Sodium salt of a mixture of the mono- and disulphonic acids (mainly the latter) of 6-chloro-quinophthalone, or of 6-chloro-2-quinolylindandione. No. 802.	Dyes wool and silk from an acid bath greenish-yellow, fast to light than Quinoline Yellow water-soluble (No. 801). Used particularly for dyeing tin-weighted silk. Light: 3.	
Flavaniline (MLB) Hydrochloride of 4-amino-2-phenyl-4-methyl-quinoline, or of α-p-amino-phenyl-lepidine. No. 803	Hydrochloride: orange-red crystalline powder. H_2O: readily soluble with a yellow colour. HCl to aqueous solution: unaltered, but concentrated acid colours the dye in substance lemon-yellow. NaOH: milky precipitate of the base which is soluble in ether with a steel-blue fluorescence and crystallises from benzene in prisms, M. P. 97°. H_2SO_4: colourless or faint dull yellow solution with a blue fluorescence. Dyes cotton, mordanted with tannin and tartar emetic, yellow, and silk yellow with a moss-green fluorescence. Not manufactured.	
Flavaniline S (MLB) No longer manufactured. Sodium salt of the sulphonic acid of 4′-amino-2-phenyl-4-methyl-quinoline. No. 804.	An orange-yellow powder. H_2O: yellow solution. HCl: unaltered. NaOH: solution decolorised. H_2SO_4: colourless solution; yellow solution on dilution. Dyes wool greenish-yellow from an acid bath. Light: 4–5.	
Quinoline Red (A) **iso-Quinoline Red** 1:1′-Benzylidene-2:2-quinocyanine chloride. No. 805 (610)	Small dark brownish-red needles with a bronzy lustre. In water: λ = 529.4 and 492.7. H_2O: insoluble cold, red solution hot. Alcohol: red solution with a yellowish-red fluorescence. H_2SO_4: colourless solution; red solution on dilution. *Quinoline Red*, on oxidation with potassium dichromate and sulphuric acid, yields benzaldehyde or benzoic acid and 2-quinolyl-iso-quinolyl-ketone, $C_{19}H_{12}N_2O$, M. P. 125.5°.	

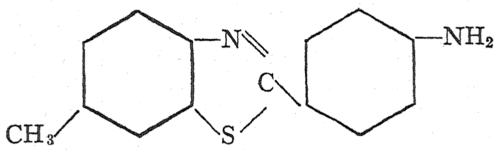
	Dyes cotton, mordanted with tannin and tartar emetic, red, and wool and silk direct rose-red, with a fine fluorescence in the latter case. Quinoline Red is too fugitive to light, however, to be of value in dyeing. Used in photography for colour-sensitising **photographic plates** to green and yellow light. Very sensitive to light; changes **in the spectroscope.**
The Isodyanines— Ethyl Red (MLB) Pinaverdol (MLB) Pinachrome (MLB) 1:6:1′-Trimethyl-isocyanine iodide or 1:6:1-trimethyl-2:4′-quinocyanine iodide. No. 807	The Isocyanines were the first sensitisers of real value for the production of extended colour sensitiveness in photographic emulsions. They sensitise mainly in the green, yellow and orange; their solutions are reddish-purple by transmitted light. Used in photography for colour-sensitising photographic plates. In water λ: Ethyl Red: 559.5; and 518.8 λ: Pinaverdol: 561.3; " 522.1 λ: Pinacyanol: Alcohol λ: Ethyl Red: 562.3; " 523.7 λ: Pinaverdol: 560.9; " 533.3 λ: Pinacyanol: 611.3; " 565.5 Determination, on self-made material. The numbers are possibly all 2.4 too low.
The Cyanines: Cyanine **Quinoline Blue** (By) **Ethyl Cyanine T (MLB)** Di-iso-amylcyanine iodide or 1:1′-di-iso-amyl-4:4′-quinocyanine iodide. No. 806 (611)	Glistening green needles. In water: λ = 592.2 and 553.7. H_2O: insoluble cold, sparingly soluble with a violet-blue colour hot; the solution has an odour of quinoline. HCl: colourless solution. NaOH: blue-bronzy precipitate which is converted into brown on warming. H_2SO_4: colourless solution and evolution of iodine on heating, unaltered on dilution. The Cyanines possess marked sensitising powers in the yellow, orange and red; their solutions are blue by transmitted light. Used formerly in photography for colour-sensitising photographic plates.
The Pinacyanols— Sensitol Red (Ilford) Pinacyanol (MLB) 1:1′-Diethylcarbo-	The Pinacyanols are blue in colour and sensitise in the yellow, orange and red, and, moreover, produce a greater sensitiveness for these regions than the Isocyanines (No. 807). λ = 611.2; 565.5 in H_2O possibly 2.5 too low.

cyanine iodide or 1:1′-diethyl-strepto-monovinylene-2:2′-quinocyanine iodide. No. 808	Used in photography for colour-sensitising photographic plates.	
Naphthacyanole (**Eastman Kodak Co.**) 1:1′-Diethyl-di-β-naphthcarbocyanine nitrate. No. 809	Naphthacyanole sensitises powerfully when added to the emulsion and when used for bathing ready-prepared plates. A strong maximum is shown in the deep red at $\lambda = 690$, and the sensitising power for the green is appreciably less than that of Pinacyanol (No. 808). Used for colour-sensitising photographic plates in place of Pinacyanol when the extreme red-sensitiveness is an advantage.	
Kryptocyanine (**Eastman Kodak Co.**) Probably, 1:1′-diethyl-strepto-mono-vinylene-4:4′-quinocyanine iodide. No. 810	Kryptocyanine sensitises in the extreme red and confers no green-sensitiveness. Thus, infra-red effects in ordinary photography can be obtained merely by the use of a strong yellow filter, and very short exposures are necessary. A concentration of 1 in 500,000 is recommended as a bathing solution. λ: not determined.	
The Dicyanines—Dicyanine A (MLB) Probably, 1:1′-diethyl-4:2′-dimethyl-6:6′-diethoxy-strepto-monovinylene-2:4′-quinocyanine iodide. No. 811	Used for colour-sensitising photographic plates when the extreme red-sensitiveness is an advantage. In alcohol: $\lambda = 600$ and 560. H_2O: dirty red solution. Alcohol: dirty blue solution. The Dicyanines are blue in colour and sensitise in the red and infra-red; they are unsuitable for use in general photographic work. Used for spectroscopic purposes in the investigation of the lower regions of the spectrum.	

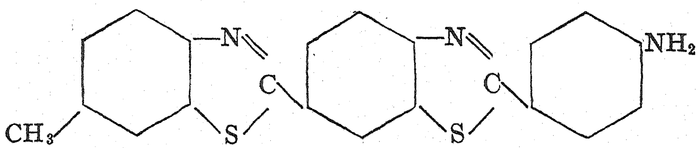
THIAZOLES (PRIMULINES)

No. 812–817

The Thiazole Colouring Matters, which were discovered by *Arthur Green*, are derivatives of Thiazole. The best known compounds of this class are Dehydrothiotoluidine and Primuline base:



Dehydrothio-*p*-Toluidine



Primuline-Base

These substances are yellow and exhibit in alcoholic solution a strong blue fluorescence. Primuline is almost insoluble in boiling alcohol. The Methylammonium base of Dehydrothio-*p*-toluidine is Thioflavine T, a basic dyestuff used in calico printing. The sulphonic acid of both substances has affinity towards cotton and may be developed on the fibre with Naphtholes and Amines after having been diazotised. (Ingrain Colours.) The Diazo-amino compounds of these Thiazoles are very strong yellow cotton colours, but extremely fugitive, whilst the Azo derivatives obtained by oxidation of the sulphonic acids—*Naphthamine yellow NN*, etc.—are amongst the best artificial dyes known. They resist light and chlorine to a very remarkable extent. Primuline-red, obtained by diazotising Primuline on cotton-fibre and developing with β-Naphthol is very fast to washing and acids, but is not a pure red and only moderately fast to light. Because of its cheapness it is still used very much. The greatest drawback of these colours is that they *cannot, as a rule, be discharged white.*

Primuline NAC, SF, superior, N, A, V, O, (BSS) (CAC) (JBS) (CCC) (S) (LP) (MLy) (StCl) (ICA) (A) (B) (By) (C) (GrE) (K) (MLB) (OeV) (NAC) (PCC) (PCC) (CN) (B) (K) (L) (MLB) Primuline Yellow (By) *Polychromine A (Gy)* Mixture of the sodium salts of the monosulphonic acids of more highly thionated dehydrothio-*p*-toluidine derivatives, together with some dehydrothio-*p*-toluidine monosulphonic acid. No. 812 (616)	A dull yellow powder. In water: partial absorption in blue and violet. H_2O: pale yellow solution with a blue fluorescence at great dilution. HCl: orange-yellow precipitate. NaOH: unaltered, or a pale yellow precipitate. H_2SO_4: pale yellow solution with a greenish fluorescence, orange-yellow precipitate on dilution. Dyes cotton direct primrose-yellow from an alkaline or neutral bath. When diazotised on the fibre and developed with a phenol or amine the so-called Ingrain Colours (N under Fastness below) are obtained. Primuline cannot be discharged or stripped by any practical means; it is attacked, but not destroyed, by oxidising agents; thus treatment of the dyed material with calcium hypochlorite, ¾ Tw., yields an orange-yellow shade fast to light, washing and chlorine. Ingrain Colours are converted into Primuline by treatment with hydrosulphite, and the regenerated colour can then be rediazotised and developed. Primuline was the first direct dye to be diazotised and developed on the fibre; the material must not be exposed to light after diazotisation: and before development. The following shades are obtained by the use of the respective developers: Phenol-yellow; Resorcinol-orange; *m*-Phenylenediamine or *m*-Toluylenediamine—reddish-brown; α-Naphthol-maroon; β-Naphthol-red; α-Naphthol-4-sulphonic acid-crimson; β-Naphthol-3:8-disulphonic acid-maroon; β-Hydroxynaphthoic-acid-anilide Bordeaux red; Ethyl-β-naphthylamine-Bordeaux (not fast to light); *p*-Amino-diphenylamine, olive-green. Brown shades of great fastness to light are produced by development with aminocarbazole (Carbazole Developer B) or *m*-diamino-benzidine (L. Cassella & Co. G,P. 266942, 273311). Photographic application. The Diazotype Process (no longer used). Coloured designs are produced upon cotton, silk or paper by exposing material, dyed with Primuline and diazotised, to the action of light beneath a positive design which it is desired to reproduce. The diazotised	

	Primuline is destroyed rapidly on the exposed portions, and when the material is placed in a solution of a phenol or amine, the protected portions only are developed, and thus a coloured design is produced upon a pale yellow ground.	
Clayton Yellow G, (CAC) (CAC) Mimosa Z, (Gy) (PCC) (Gy) (Gy) Sodium salt of the diazomino-compound of dehydrothio-*p*-toluidine sulphonic acid, or of the mixed diazoamino-compound of dehydrothio-*p*-toluidine sulphonic acid and Primuline. No. 813 (198)	A yellowish-brown powder. In water: partial absorption in blue and violet. H_2O: yellow solution. Alcohol: yellow solution. HCl to aqueous solution: orange-yellow precipitate. NaOH: reddish-yellow solution and precipitate. H_2SO_4: brownish-yellow solution, yellow precipitate on dilution. Dyes cotton direct, and half-silk from a soap or faintly alkaline bath, or from a neutral bath with addition of 10–20% of salt, and silk from a faintly acid (acetic acid) bath, bright greenish yellow. **Light: 5.** Not discharged by any of the usual reagents on cotton and is used for coloured discharges with hydrosulphite. Used also for the preparation of an indicator paper for free alkali. Clayton Yellow paper is reddened by caustic alkalies, even in extremely dilute solution, whereas it is not affected appreciably by sodium carbonate or ammonia. Clayton Yellow paper is unaffected by alkali salts of phenols and consequently is suitable for the titration of phenols and naphthols with alkali hydroxides (C. RiS). The yellow of greatest purity but also very poor in resistance to light, acids and alkalies.	
Chlorazol Fast Yellow B, (BDC) Diphenyl Chlorine Yellow FF, (Gy) Triazol Fast Yellow G, 2G, GN, (GrE) Naphthamine Yellow N (K) Sodium salt of sul-	Brownish-yellow to bright orange powders. In water: partial absorption in blue and violet. H_2O: yellow solution. Alcohol: insoluble. HCl to aqueous solution: orange-yellow precipitate. NaOH: unaltered, or an orange-yellow precipitate. H_2SO_4: blood-red solution, brownish-yellow precipitate on dilution. Dyes cotton direct, or wool from an acid bath, and silk from a soap bath, level yellow. Light: 1–2. Used for the production of delicate cream shades and for dyeing compound shades.	

pho-benzenyl-amino-thio-cresol-azo-sulpho-benzenylamino-thio-cresol. No. 814 (617)	**The fastest direct yellow to light and chlorine.**	
Rhoduline Yellow T (By) Methylene Yellow H (MLB) Thioflavine T Chloromethyl-derivative of di-methyl-dehydro-thio-*p*-toluidine. No. 815 (618)	A yellow crystalline powder. In water: partial absorption in blue and violet. H_2O: yellow solution. Alcohol: readily soluble with a yellow colour and a green fluorescence. HCl to aqueous solution: unaltered. NaOH: yellow precipitate. H_2SO_4: almost colourless solution with a dark green fluorescence; yellow solution on dilution. Dyes cotton, mordanted with tannin and tartar emetic, pure greenish-yellow, and silk from a soap bath yellow with a green fluorescence. Light: 3–4. Used also in calico printing. Discharged white by chlorate on cotton, and coloured discharges are obtained with hydrosulphite. Important for calico printing.	
Dianil Pure Yellow HS, (MLB) **Thioflavine S** Sodium salt of the sulphonic acid of methylated Primuline base. No. 816 (615)	A yellow powder. In water: partial absorption in blue and violet. H_2O: golden-yellow solution. Alcohol: less readily soluble than in water; yellow solution with a green fluorescence. HCl to aqueous solution: orange-yellow precipitate. NaOH: unaltered, or a soluble yellow precipitate. H_2SO_4: brownish-yellow solution with a blue fluorescence, orange-yellow precipitate on dilution. Dyes cotton direct canary-yellow from an alkaline or neutral bath; does not exhaust well. Light: 4–5. Used also for dyeing unions and half-silk; also in calico printing for coloured discharges with hydrosulphite NF. Very beautiful yellow, but with almost as bad qualities as 813.	
Chromine G (*K*) Components—Dehydrothio-*p*-toluidine and Sulphur, Methylate and Sulphonate. No. 817 (614)	A brownish-yellow powder. H_2O: brownish-yellow solution hot. HCl: brownish precipitate. NaOH: soluble greenish-yellow precipitate. H_2SO_4: yellow solution with a blue fluorescence, brownish precipitate on dilution. Dyes cotton direct, or half-silk from a boiling faintly alkaline bath to which 2% of sodium phosphate and salt or	

	Glauber's salt are added, and silk from an almost boiling bath containing ½% of sodium acetate, lemon-yellow, moderately fast to washing, alkalies and chlorine, reddened by acids and not fast to light. Has never been manufactured.	

[1]INDAMINES, INDOANILINES AND INDOPHENOLS

No. 818–823

Phenylene Blue Hydrochloride of *p*-aminophenyl-*p*-benzoquinone-di-imine. *No.* 818	Long needles with a green metallic lustre. H_2O: greenish-blue solution. HCl: green solution; the acid solution decomposes rapidly with formation of benzoquinone. Phenylene Blue on reduction is converted into *pp*-diamino-diphenyl-amine, from which the former is regenerated by oxidation. When Phenylene Blue is boiled with aniline hydrochloride in neutral solution, Phenosafranine (No. 840) is formed.	
Bindschedler's Green Chloride or zinc double chloride of *p*-dimethylamino-phenyl-dimethyl-*p*-benzo-quinone-di-imine. No. 819	Copper-coloured crystals with a green metallic lustre. H_2O: green solution. Alcohol: insoluble. Bindschedler's Green on reduction is converted into *pp'*-tetra-methyldiamino-diphenylamine, from which the former is regenerated by oxidation. When Bindschedler's Green is boiled with aniline hydrochloride in neutral solution, the corresponding Safranine is formed.	
Toluylene Blue Chloride of diamino-methyl-phenyl-dimethyl-*p*-benzo-quinone-di-imine. No. 820	Glistening bronzy crystals. H_2O: blue solution. Alcohol: blue solution. HCl to aqueous solution: reddish-brown solution. NaOH: brown tarry precipitate of the colour-base. Toluylene Blue on reduction is converted into *p*-dimethylamino-diamino-methyl-diphenylamine, from which the former is regenerated by oxidation. When Toluylene Blue is boiled with aniline hydrochloride in neutral solution the corresponding Safranine is formed.	
Indophenol pdr. or paste, (*DH*)	A dark brown powder or dark blue bronzy paste. In ethyl alcohol: λ = about 592.2.	

[1] Not on the market. Intermediates for Azines, Thiazines, Sulphur dyes, etc.

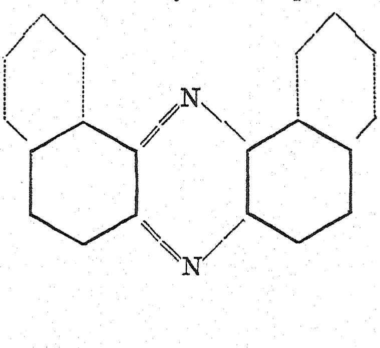
p-Dimethylamino-phenyl-α-naphtha-quinone-imine. No. 821 (619)	H_2O: insoluble. Alcohol: blue solution. HCl to alcoholic solution: reddish-brown solution. NaOH: unaltered. H_2SO_4: yellowish-brown solution, brown precipitate on dilution. $SnCl_2$: the alcoholic solution is decolorised owing to the formation of Indophenol White, but the colour quickly returns when the liquid is rendered faintly alkaline. HNO_3: decomposition. Dyes cotton from a hydrosulphite vat indigo-blue, almost as fast to light and milling as Indigo, fast to alkalies, but not fast to acids, and rubs less than Indigo. Used only in conjunction with Indigo for dyeing cotton, wool, and unions from a hydrosulphite vat, Cuve mixte (DH), and in calico printing. No longer on the market.	
Carbazole Indophenol Carbazole-*p*-benzo-quinone-imine. No. 822	A deep violet-blue powder. H_2O: insoluble. Alcohol: reddish-violet solution hot. H_2SO_4: cornflower-blue solution. Used for the manufacture of Sulphide Dyes and Thionated Vat Dyes, such as Hydron Blue R (No. 969).	
Ethyl Carbazole **Indophenol** N-Ethylcarbazole-*p*-benzoquinone-imine. No. 823	A dark blue powder. H_2O: insoluble. Alcohol: bluish-violet solution hot. H_2SO_4: greenish-blue solution. Used for the manufacture of Thionated Vat Dyes, such as Hydron Blue G (No. 971).	

AZINES

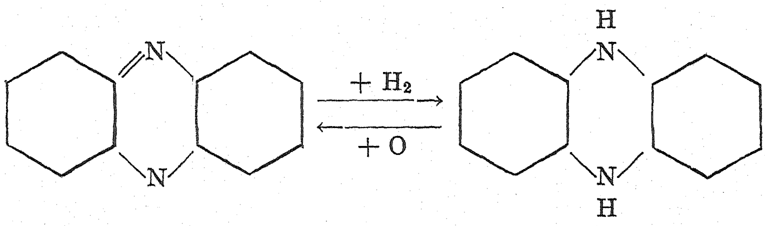
No. 824–875

Azine Dyestuffs

The Azines are characterised by the Group:



This group occurs in different dyestuffs, such as benzene-azines, benzene-naphthalene-azines, naphthalene-azines and also anthraquinone-azines. In this Group, however, only the benzene and naphthalene-azines are discussed, since the anthraquinone-azines are dealt with under the Anthraquinone Vat-dyestuffs. Azines, without any exception, may be reduced with mild reducing agents, such as hydrosulphite, zinc dust and water, etc., to the corresponding hydro-azines:



These hydro-azines are very easily reoxidised by air, and are thus readily distinguished from the leuco compounds of the carbonium-salts (Triphenylmethane dyestuffs, Pyronines), which are not readily oxidised by air.

The Azines belong to the dyestuffs which have been longest known. Mauvein, or Perkin's Mauve was the first artificial dyestuff, and it belongs to the group of the aryl-pheno-azine dyestuffs.

The importance of this group is diminishing, because the cheap azo colouring matters are replacing these beautiful but fugitive products. Nevertheless, many of the members of the azine class are of very great importance. Safranine and Indoin are still employed, whilst the Indulines and the Nigrosines are amongst the most important colouring matters. The differentiation of carbonium dyes and the azines is best effected by spectroscopic analysis. There are basic and acid azine dyestuffs and, whilst most of them are not fast to light, some are remarkable in this respect. For example, the Wool fast blues and the Indulines show a fastness towards light which ranks almost with that of the Anthracene Acid Dyestuffs. One of the most important azine dyes, namely, Aniline Black, is never produced in substance, but exclusively on the fibre.

Flavinduline O, II (*B*) Phenyl-phenantraphene azonium chloride. No. 824 (668)	A brownish-yellow to orange-red powder. H_2O: Orange-yellow solution. HCl: Scarcely altered. NaOH: yellowish-green precipitate which changes to greyish-yellow. H_2SO_4: Bluish-red solution; yellow solution on dilution. Dyes cotton, mordanted with tannin and tartar emetic, brownish-yellow, but is more suitable for printing with tannin, particularly for discharge printing. Used to a limited extent in calico printing and for dyeing leather.	
Neutral Red, extra, (DH) (C) (MLy) (C) Toluylene Red Neutral Red (DH) is no longer manufactured. Amino-dimethylamino-toluphene-azonium chloride. No. 825 (670)	A dark blackish-green powder; the base forms orange crystals $+H_2O$. H_2O: Crimson-red solution. λ: 526.0. Alcohol: Readily soluble, with a magenta-red colour and a faint brownish-red fluorescence. HCl to aqueous solution: Bluer solution, or pure blue solution with a large excess. NaOH: Yellowish-brown precipitate, soluble in ether with a pink colour and an orange fluorescence. H_2SO_4: Green solution; blue solution and then magenta-red solution on dilution. Dyes cotton, mordanted with tannin and tartar emetic, bluish-red of low fastness; wool and silk are not dyed. Light: 4–5. Neutral Red possesses a strong desensitising action on photographic emulsions.	
Neutral Violet extra, (DH) (C) (MLy) (C) Neutral Violet (DH) is no longer manufactured. Probably, mainly amino-dimethylamino-p-dimethylamino-phenyl-amino-diphenazonium chloride. No. 826 (669)	A greenish-black powder; the dust exerts a very irritating action on the mucous membrane. H_2O: Readily soluble with a violet-red colour. $\lambda = 533.0$. HCl: Scarcely altered at first, but blue solution with a large excess. NaOH: Brown precipitate. H_2SO_4: Green solution; blue solution and then violet solution on dilution. HNO_3: *id.* Dyes cotton, mordanted with tannin and tartar emetic, reddish-violet of low fastness. Light: 4. Used to a limited extent in calico printing.	
Induline Scarlet (B) Amino-ethyl-tolunaphthazonium chloride. No. 827 (671)	A red powder. In alcohol: λ = 537.5, 499.3 and 467.0. H_2O: Red solution. Alcohol: Orange-red solution, with a yellow fluorescence. HCl to aqueous solution: Unaltered. NaOH: Violet resinous precipitate. Ammonia: Unaltered. NaCl: Precipitate of the	

	hydrochloride. H_2SO_4: Wine-red solution; green solution and then red solution on dilution. Dyes cotton, mordanted with tannin and tartar emetic, scarlet-red. Light: 3–4. Used in calico printing, particularly for discharge printing. Induline Scarlet acts as a catalyst in discharging Naphthylamine Claret (No. 82), on the fibre (cf. G, P, 184381). Rongalite Special (B) and hydrosulphite conc. special (MLB) contain Induline Scarlet.	
Azocarmine GX, G paste, (DuP) (B) Rosinduline GXF **(K)** Sodium salt of phenyl-amino-phenyl-naphthophenazine disulphonic acid, or of phenylrosinduline disulphonic acid. No. 828 (672)	A red paste with a golden lustre. In alcohol: λ = 543.5, 503.2 and 471..3 H_2O: Sparingly soluble, with a bluish-red colour. HCl: Red precipitate, soluble in water. NaOH: Unaltered. H_2SO_4: Green solution; red precipitate on dilution. HNO_3: *id.* Dyes wool and silk from an acid bath very level bluish-red, fast to light and acids; cotton effects are unstained. Light: 3. Used for dyeing compound shades; also as a substitute for Archil.	
Azocarmine B, BX, (B) **Rosinduline 2B bluish,** (K) Sodium salt of phenyl-amino-phenyl-naphthophenazine trisulphonic acid, or of phenylrosinduline trisulphonic acid. No. 829 (673)	A reddish-brown powder. In water: λ = 545.5, 504.0 and 473.2. H_2O: Readily soluble, with a bluish-red colour. HCl: Brown precipitate. NaOH: Unaltered. H_2SO_4: Green solution, brown precipitate on dilution. HNO_3: *id.* Dyes wool red from an acid bath. Level-dyeing 1; relation to cotton 1; relation to silk 4. Light: 4–5. Used for dyeing compound shades; also as a substitute, of equal fastness, for Archil.	
Rosinduline 2G (K) Sodium salt of a mono-sulphonic acid of rosindone. No. 830 (674)	A scarlet-red powder. In alcohol: λ = 539.5, 501.6 and 470.7. H_2O: Scarlet-red solution. HCl: Yellow precipitate. NaOH: Scarlet-red precipitate. H_2SO_4: Dull green solution, separation of golden-yellow crystals on moderate dilution and keeping. Dyes wool and silk orange-red from an acid bath. Light: 4–5. Level-dyeing 2; relation to cotton 1; relation to silk 5.	
Rosinduline G (K) Sodium salt of ros-	A red powder. H_2O: Orange-red solution hot, gelatinises on cooling.	

indone-6-sulphonic acid. No. 831 (675)	HCl: Yellow precipitate. NaOH: Soluble scarlet-red precipitate. H_2SO_4: Dull green solution, brownish precipitate on dilution. HNO_3: *id.* Dyes wool and silk level scarlet-red from an acid bath; cotton effects are unstained. Used mainly in printing wool and silk, particularly for coloured discharges.	
Neutral Blue (*MLy*) (*C*) Dimethylamino-phenylnaphtho-phenazonium chloride or dimethyl-iso-rosinduline chloride. No. 832 (676)	A dull brown powder. H_2O: Readily soluble, with a violet colour. $\lambda = 564.0$. Alcohol: Readily soluble with a reddish-violet colour. HCl to aqueous solution: Unaltered, or bluer solution with a large excess. NaOH: Violet precipitate. H_2SO_4: Brownish-violet solution; violet solution on dilution. Dyes cotton, mordanted with tannin and tartar emetic, rather dull blue, not fast to light and soap. Light: 4–5.	
Wool Fast Blue BL, GL, (By) Wool Fast Violet B (By) In general, sulphonic acids of di-alkyl-amino-phenylamino-phenyl-naphtho-phenazonium chloride. No. 833	*Wool Fast Blue BL—* A dark violet-blue powder. H_2O: Bluish-violet solution. $\lambda = 548.5$ (BL). $\lambda = 582.0$ (GL). Alcohol: Violet solution. HCl to aqueous solution: Dark blue precipitate. NaOH: Orange-red solution and faint precipitate. H_2SO_4: Green solution; blue solution and then bluish-violet precipitate on dilution. HNO_3: decomposition. Dyes wool from an acid bath, or wool and silk from a neutral bath, reddish-blue, fast to light and milling, and unaltered by chroming. *Wool Fast Violet B—* A black powder. H_2O: Dull violet solution. $\lambda = 561.0$. Alcohol: Bluish-red solution. HCl to aqueous solution: Reddish-violet precipitate. NaOH: Wine-red precipitate. H_2SO_4: Green solution, bluish-red solution and then reddish-violet precipitate on dilution. HNO_3: decomposition. Dyes wool from an acid bath, or wool and silk from a neutral bath, violet of good fastness to light, stoving, dry-steaming and alkalies. Light: 2. Important Wool Dyes.	
Azine Green GB (L) Dimethylamino-phenylamino-phenyl-naphthophenazonium chloride. No. 834.	A dark green powder. H_2O: green solution. Alcohol: Green solution. HCl to aqueous solution: Green precipitate. NaOH: Green precipitate. H_2SO_4: Brownish solution, green solution on dilution.	

	Dyes cotton, mordanted with tannin and tartar emetic, dark bluish-green, moderately fast to light and washing. Used also in calico printing.
Azine Green S (*L*) Components— Azine Green GB (No. 834) and Sulphonate. No. 835	A bluish powder. H_2O: Bluish-green solution. Alcohol: Almost insoluble. HCl to aqueous solution: Scarcely altered. NaOH: Scarcely altered. H_2SO_4: Bluish-violet solution; brownish solution and then bluish-green solution on dilution. Dyes wool from an acid bath bluish-green, fast to light. Light: 2–3.
Basle Blue R (*DH*) Dimethylamino-*p*-tolylamino-*p*-tolylnaphthophenazonium chloride. No. 836 (677)	A brown crystalline powder. H_2O: Bluish-violet solution. $\lambda = 565.0$. HCl: Blue precipitate. NaOH: Blue-black precipitate; BB blue precipitate. H_2SO_4: Greenish-brown solution (BB olive-brown solution); green solution, violet solution and then bluish-violet precipitate on dilution. Dyes cotton, mordanted with tannin and tartar emetic, blue, and wool reddish-blue from an acid or alkaline bath. Light: 4. Suitable for topping Indigo. Largely replaced by Indoine Blue (No. 135).
Basle Blue S (DH) Components— Basle Blue R (No. 836) and Sulphonate. No. 837	A coppery powder. H_2O: Readily soluble. H_2SO_4: Yellow solution; green solution and then blue solution on dilution. Dyes wool and silk from an acid bath blue of good fastness to light and alkalies. Light: 4.
Azine Scarlet G (*MLB*) Diamino-methylditolazonium chloride. No. 838	A brown powder. H_2O: Red solution. $\lambda = 496.5$. Alcohol: Fluorescent solution. HCl to aqueous solution; Red solution, or blue solution with excess. NaOH: Unaltered. H_2SO_4: Bluish-green solution; violet solution and then red solution on dilution. Dyes cotton, mordanted with tannin and tartar emetic, red, yellower and less bright than Safranine (No. 841). Light: 4.
Fast Neutral Violet B, (MLy) (C) Fast Neutral Violet paste (C) Dimethylamino-ethylamino-ethyldiphenazonium chloride. No. 839 (678)	A dark bronzy glistening paste or bronzy powder. In water: $\lambda = 582.0$ and 542.5. H_2O: Reddish-violet solution. Alcohol: Reddish-violet solution. HCl to aqueous solution: Unaltered, or the colour is changed to bluish-violet and finally to reddish-blue with a large-excess. NaOH: Partial precipitation with excess. H_2SO_4: Purple-grey solution; blue solution, bluish-

	violet solution and then reddish-violet solution on dilution. Dyes cotton, mordanted with tannin and tartar emetic, violet, fast to light and washing. Light: 3.	
Safranine B extra (B) **Phenosafranine** Diamino-phenyl-di-phenazonium chloride. No. 840	Green glistening crystals. H_2O: Readily soluble with a red colour. Not distinct in alcohol about: λ = 533.0. Alcohol: Red solution, with a greenish-yellow fluorescence. HCl to aqueous solution: Blue-red solution, or violet solution, with excess, or blue solution with a very large excess. NaOH: Reddish-brown precipitate, soluble in much water. H_2SO_4: Green solution; blue solution, violet solution and then red solution on dilution. Dyes cotton, mordanted with tannin and tartar emetic, red, bluer than Safranine (No. 841). Phenosafranine exerts a desensitising action on photographic emulsions. Complex mercury compounds of Phenosafranine and its homologues, such as Trypasafrol, possess therapeutic properties: (Saccharin-fabrik vorm. Fahlberg, List & Co. G. P. 286097).	
Safranine T conc. (BDC) (B) **Safranine** Prima, Y, T extra, A, Y extra, superfine double B, BOOO, GOOO, NB, G, J2E, extra conc., extra G, MP, FF extra No. O, O, GGS, S, G extra, OOF, RAE, AG, AGT extra, conc. (CR) (H) (W) (Sch) (DH) (Gy) (L) (MLB) (NI) (tM) (H) (CCC) (DuP) (NAC) (StD) (Sch) (Gy) (SCI) (B) (CN) (MC) (A) (C) (L) (StD) (FB) (A)	A reddish-brown powder. In alcohol: λ = 539.0 and 503.2. H_2O: Red solution. Alcohol: Red solution with a yellowish-red fluorescence. HCl to aqueous solution: Bluish-violet solution. NaOH: Brownish-red precipitate. H_2SO_4: Green solution; blue solution and then red solution on dilution. Dyes cotton, mordanted with tannin and tartar emetic, red, and wool from a neutral, acid or alkaline bath red, very fugitive to light. Wool, level-dyeing 1; relation to cotton, 2–3; relation to silk 4. Light: 4–5. Used in calico printing for shading Alizarin Red and for compound shades in conjunction with Chrysoidine (Nos. 20, 21), Auramine (No. 655), Methylene Blue (No. 922), &c.; also to a less extent for dyeing silk, half-silk, paper, jute, coco fibre, &c.; also for the manufacture of Azo-dyes (Nos. 133, 134, 135, 136, 137). Safranine exerts a desensitising action on photographic emulsions. The condensation product of Safranine and tannin in hot 8% sodium hydroxide solution possesses no purgative action and may be used for the treat-	

(By) (C) (C) (L) (K) (MLB) Mixture of diamino-phenyl-ditolazonium-chloride and diamino-*o*-tolyl-ditolazonium chloride. No. 841 (679)	ment of trypanasoma and other protozoic infections: (Act. f. Anilfabr. U. S. P., 1183711, F. P. 463357, G. P. appl. A24294). No longer much used.	
Methylene Violet BN pdr., RRA pdr., RRN pdr., 3RA extra (MLB) Clematine (Gy) Zinc double chloride of amino-di-methyl-amino-phenyl-diphen-azonium chloride, or of asymm. di-methyl-safranine. No. 842 (680)	A brown powder. In alcohol: Methylene Violet RRN, $\lambda = 555.2$ and 516.5. H_2O: Readily soluble, with a violet-red colour. Alcohol: Readily soluble with a violet-red colour. HCl to aqueous solution: Bluish-violet solution. NaOH: brownish-red precipitate. H_2SO_4: Green solution; blue solution and then violet solution on dilution. Dyes cotton, mordanted with tannin and tartar emetic, reddish-violet. Light: 4. *Methylene Violet RRA:* In alcohol: $\lambda = 559.3$; in H_2O, not sharp, 566.5; 537.5. Used mainly in calico printing, particularly the brands Methylene Violet RRA, 3RA.	
Brilliant Heliotrope 2R conc. (LBH) Clematine (*Gy*) Amino-dimethylam-inophenyl-toluphen-azonium chloride. No. 843 (683)	A dark powder with a metallic lustre. In ethyl alcohol: $\lambda = 555.2$ and 516.5. H_2O: Reddish-violet solution. Alcohol: Reddish-violet solution with an orange fluorescence. HCl to aqueous solution: Blue solution. NaOH: Soluble dark red precipitate. H_2SO_4: Green solution; blue solution and then reddish-violet solution on dilution. Dyes cotton, mordanted with tannin and tartar emetic, reddish-violet. Light: 4. Used also in calico printing. Safranine MN exerts a desensitising action on photographic emulsions.	
Rhoduline Violet (By) *Rhoduline Red G, GD* (By) Amino-dinethylamino-phenyl-toluphen-azonium chloride. No. 844 (684)	*Rhoduline Violet:* Glistening blackish-green powder; *Rhoduline Red B, G.:* Brown powders. In alcohol: *Rhoduline Red G*, $\lambda = 541.0$ and 504.0; *Rhoduline Violet*, $\lambda = 554.2$ and 514.5. H_2O: Red solution. Alcohol: Soluble, with a red to brown fluorescence. HCl to aqueous solutions: Dark precipitate, or violet to blue solutions. NaOH: Brown	

	precipitates. H_2SO_4: Green solution; blue solution, violet solution and then red solution on dilution. Dyes cotton, mordanted with tannin and tartar emetic, bluish-red of good fastness to washing and of moderate fastness to light. Light: 4–3.	
Methyl Heliotrope O (MLB) Rosolane BO, O, R paste, T, (*MLB*) Amino-phenylamino-phenyl-toluphenazonium chloride. No. 845 (687)	Used also in calico printing. Greenish-olive powder. In water: λ = 550.5. H_2O: Sparingly soluble, with a reddish-violet colour. Alcohol: Very sparingly soluble. HCl to aqueous solution: Unaltered, or blue solution and then green solution with a large excess. NaOH: Precipitate of the colour-base. H_2SO_4: Green solution; blue solution and then red solution on dilution. Dyes silk, from a soap bath, violet-pink, used particularly for tinting white-bleached silk; and wool from a neutral bath or from a soap bath. Dyes, cotton, mordanted with tannin and tartar emetic, violet-pink. Light: 3–4. Rosolane O: 551.5; In alcohol: 560.0. Used also in calico printing.	
Mauve, Mauveine, Mainly, amino-phenyl-amino-*p*-tolyl-ditolazonium sulphate, together with lower homologues. No. 846 (688) Manufactured since 1862.	Reddish-violet paste or crystals. H_2O: Insoluble, cold; sparingly soluble, with a reddish-violet colour, on boiling. λ = In Water: $\frac{543.8}{543.0}$ 537.3 Alcohol: purple solution. HCl to aqueous solution: unaltered. NaOH: bluish-violet precipitate. H_2SO_4: olive-green solution, green solution, blue solution and then reddish-violet solution on dilution. Dyes silk reddish-violet, and cotton, mordanted with tannin and tartar emetic, or cotton direct, a rather bluer shade. It is faster to light than Methyl Violet (No. 680). Used for whitening skein-silk; also formerly for the manufacture of the lake used for printing the old *British lilac penny stamps* (Queen Victoria issue); also in calico printing, dissolved in acetin and thickened with dextrin. Light: 3.	
Iris Violet (B) *Heliotrope B, 2B,* (K) Tetraethyldiamino-phenyl-diphenazonium chloride, or tetraethylphenyo-	A blackish-grey powder. In water: *Amethyst Violet:* λ = 589.0 and 545.5. H_2O: Reddish-violet solution. Alcohol: Magenta-red solution with a bluish fluorescence. HCl to aqueous solution: Blue solution. NaOH: Unaltered. H_2SO_4: Green solution;	

safranine chloride. No. 847 (686)	blue solution and then bluish-violet solution on dilution. Light: 4. Dyes silk violet with a red fluorescence. Amethyst Violet exerts a desensitising action on photographic emulsions.	
Brilliant Rhoduline Red B, BD paste, (By) Methylamino-ethyl-amino-phenyl-ditol-azonium chloride. No. 848 (684)	*Brilliant Rhoduline Red B*— A violet-brown powder. In ethyl alcohol: $\lambda = 545.7$ and 506.5. H_2O: Bluish-red solution. Alcohol: Bluish-red solution with an orange fluorescence. HCl to aqueous solution: Brown solution; violet solution and then blue solution with a large excess. NaOH: Brown flocculent precipitate. H_2SO_4: Green solution; blue solution, violet solution and then bluish-red solution on dilution. Dyes cotton, mordanted with tannin and tartar emetic, bluish-red of good fastness to washing and of moderate fastness to light. Light: 4. Used also for dyeing wool and silk; also for coloured discharges in calico printing, as it is stable to reducing agents; also for staining microscopical preparations.	
Indazine GB, L, M, P, (*MLy*) (*C*) Mixture of dimethyl-amino-phenyl-amino-phenyl-diphenazonium-chloride and its *p*-dimethyl-amino-phenyl-amino--derivative. No. 849 (689)	Indazine M (C)— A blue powder with a bronze reflex. In water: $\lambda = 593.5$ and 555.0. H_2O: Readily soluble with a violet-blue colour. Alcohol: Readily soluble with a violet-blue colour. HCl to aqueous solution: Bluer solution. NaOH: Blackish-blue precipitate. H_2SO_4: Blackish-green solution; blue solution on dilution. Dyes cotton, mordanted with tannin and tartar emetic, bright indigo-blue of good fastness to washing and very fast to acids and alkalies. Light: 4–3. Used also for dyeing half-silk; also formerly for topping Indigo on linen.	
Metaphenylene Blue B BB, BBR, RJ, (*MLy*) (*C*) (*C*) Dimethylamino-*o*-tolylamino-*o*-tolyl-diphenazonium chloride. No. 850 (691)	A black powder. In water: *Metaphenylene Blue B*, $\lambda = 579.5$. H_2O: Dark bluish-violet solution. Alcohol: Readily soluble with a blue colour. HCl to aqueous solution: Bluer solution. NaOH: Violet precipitate. H_2SO_4: Bluish-grey solution; blue solution on dilution. When reduced with zinc dust, the colour only returns partially on exposure to air-oxidation.	

	Dyes cotton, mordanted with tannin and tartar emetic, blackish-greenish, or reddish-blue. Light: 4.	
Diphene Blue R, (A) Metaphenylene Blue R (*C*) Probably, dimethyl-amino-*p*-tolyl-amino-*p*-tolyl-di-phenazonium chloride. No. 851 (690)	*Metaphenylene Blue R*— A brown powder. In water: λ = 549.0. H_2O: Violet solution. Alcohol: Bluish-violet solution. HCl to aqueous solution: Bluish-violet precipitate. NaOH: Dark brownish-violet precipitate. H_2SO_4: Dull greenish-black solution; blue solution and then bluish-violet precipitate on dilution. *Diphene Blue B*—560.0. A black powder. H_2O: Violet solution. Alcohol: Reddish-violet solution. HCl to aqueous solution: Reddish-violet precipitate, or blue solution with a large excess. NaOH: Brown precipitate. H_2SO_4: Black solution; green solution, blue solution and then reddish-violet precipitate on dilution. Dyes cotton, mordanted with tannin and tartar emetic, reddish-blue. Used in calico printing for the production of blue shades, fast to light and washing. Diphene Blue Base is used also for dyeing cotton and silk.	
Giroflé (DH) Tannin Heliotrope (*MLy*) (*C*) Amino-dimethyl-amino-xylyl-xylo-phenazonium chloride. No. 852 (685) Giroflé is no longer manufactured.	A brown paste or greyish-green powder. In ethyl alcohol: λ = 555.2 and 516.5. H_2O: Magenta-red solution. Alcohol: Magenta-red solution. HCl to aqueous solution: Unaltered, or blue solution with a large excess. NaOH: Red precipitate, soluble in water. H_2SO_4: Green solution; blue solution and then red solution on dilution. Dyes cotton, mordanted with tannin and tartar emetic, reddish-violet of good fastness to light and washing. Used in calico printing with tannin for bright heliotrope and for shading printed Alizarine Violet. Light: 3–4. Giroflé exerts a desensitising action on photographic emulsions. Acid Cyanine BD—	
Acid Cyanine B, BD, BF, BFL, BL, G, GD, GF, GFL, (*A*) No. 853 Acid Azo dye after Formanek page 234	A brownish-black powder. H_2O: Reddish-violet solution. λ for B. F.: 576.0; other brands, mixtures. Alcohol: Partially soluble with a green colour. HCl to aqueous solution: Bluish-red solution. NaOH: Dull reddish-violet solution. H_2SO_4: Brownish-black solution (part dissolves with a red colour), part with a green colour and part with a yellow	

	colour); blue solution and then bluish-red solution on dilution. Dyes wool from an acid bath level-blue. Used also for dyeing knitting yarns and for compound shades.	
Ethyl Blue BD, BF, RD, (*MLB*) Tetramethyldiamino-β-naphthyl-tolu-phenazonium chloride. No. 854	*Ethyl Blue BD*— A brownish-black powder. H_2O: Violet solution. Points to mixtures of several dyes. Alcohol: Bluish-violet solution. HCl to aqueous solution: Bluish-violet solution. NaOH: Violet precipitate. H_2SO_4: Green solution; blue solution and then bluish-violet solution on dilution. Dyes cotton mordanted with tannin and tartar emetic, and linen indigo-blue, fast to light and washing. Light: 3. *Ethyl Blue RD*— A black powder. H_2O: Wine-red solution. Alcohol: Violet solution. HCl to aqueous solution: Duller solution, or blue solution with a large excess. NaOH: Reddish-brown precipitate. H_2SO_4: Yellowish-green solution (part dissolves with a green colour and part with a brownish-yellow colour); greenish-blue solution and then violet solution on dilution. Used mainly in calico printing in the form of a solution of the colour-base in acetic acid and acetin.	
Naphthazine Blue (*MLB*) (*WDC*) Sodium salt of dimethylamino-β-naphthylamino-sulpho-β-naphthyl-diphenazonium sulphonate. No. 855 (692)	A bronzy glistening powder. H_2O: Blue solution. $\lambda = 573.5$. HCl: Bluer solution and precipitate. NaOH: Rather duller solution. H_2SO_4: Bluish-green solution; blue solution and precipitate on dilution. Dyes wool from an acid bath blue of moderately good fastness to light and milling and of good fastness to acids and alkalies; the fastness to milling is increased by after-chroming. Light: 3–4.	
Naphthyl Blue (*K*) Sodium salt of a sulphonic acid of diphenyldiamino-phenyldi-naphthazonium. No. 856 (693)	*Milling Blue*— A bronzy powder. In water: $\lambda = 616.2$ and 558.0. H_2O: Blue solution. HCl: Blue precipitate. NaOH: Bluish-black precipitate. H_2SO_4: Bluish-green solution; blue solution on dilution. Dyes chrome-mordanted wool blue. *Naphthyl Blue*— Dyes silk from a faintly acid soap bath violet-blue with a red fluorescence, fast to light and washing.	

	Naphthyl Violet— A violet-black powder. H_2O: Reddish-violet solution. Alcohol: Reddish-violet solution. HCl to aqueous solution: Reddish-violet precipitate. NaOH: Duller solution. H_2SO_4: Green solution, reddish-violet precipitate on dilution. Dyes silk from a faintly acid soap bath reddish-violet with a red fluorescence, fast to light and washing. Light: 3.	
Sudan Red Magdala Red *Naphthalene Red* Mixture of amino-naphthyl-dinaphthazonium chloride and diamino-naphthyl-dinaphthazonium chloride. No. 857 (694)	A dark brown powder. In ethyl alcohol: λ = 573.8, 529.0 and 489.5. H_2O: Sparingly soluble hot with a red colour. Alcohol: Red solution with an orange fluorescence; the chloride crystallises from alcohol in green needles with a metallic lustre. HCl to aqueous solution: More violet solution. NaOH: Reddish-violet precipitate, soluble in ether to a fluorescent solution. H_2SO_4: Greyish-violet solution, violet-red precipitate on dilution. Dyes silk from a soap bath pink with a slight fluorescence; the fluorescence is particularly fine on velvet. Light: 3–4. Used to a limited extent for the production of delicate pink shades on silk.	
Paraphenylene Violet (*WDC*) Possibly, an amino-phenyl-rosinduline chloride. No. 858 (695)	A dark bronzy glistening powder. H_2O: Violet solution. λ = 542.5. HCl: Slightly redder solution. NaOH: Brownish-violet precipitate. H_2SO_4: Bluish-violet solution; blue solution and then violet solution on dilution. Dyes cotton, mordanted with tannin and tartar emetic, violet moderately fast to light, washing, alkalies and acids. Light: 4. Used also in calico printing.	
Indamine Blue, B, R, (*MLB*) Amino-diphenyldiamino-phenyl-diphenazonium chloride. No. 859 (696)	*Indamine Blue R*— A dark blue paste or powder. H_2O: Bluish-violet solution. λ: Mixtures. HCl: Redder solution. NaOH: Dark reddish-violet precipitate. H_2SO_4: Blue solution; redder solution and blue precipitate on dilution. Dyes cotton, mordanted with tannin and tartar emetic, bluish-violet. The fastness is increased by after-treatment with dichromate and copper sulphate. Light: 3–4.	
Induline spirit-soluble.	A bluish-black or brownish-black powder.	

(AJ) (CR) (H) (RD)
(W) (GCC) (HM) (SCI)
(Ge) (LP) (B) (BK)
(By) (CJ) (NI) (tM)
Spirit Induline.
A, 5B, B, R conc.
(CV) (H) (JBS) (WSS)
(BDC) (LBH) (MC) (tM)
(tM)
Mixture of amino-diphenyldiamino-triphenyltriamino- and tetraphenyltetramino-phenyldiphenazonium chloride.
No. 860 (697)

Induline R spirit-soluble (SCI), λ = 543.5.
H_2O: Insoluble.
Alcohol: Bluish-violet or blue solution. HCl to alcoholic solution: Almost pure blue solution. NaOH to alcoholic solution: Dull red or reddish-violet solution and precipitate. H_2SO_4: Blue solution, violet-blue precipitate on dilution. HNO_3: *id.*
Used for the production of the corresponding Induline water-soluble (No. 861) by sulphonation; also (mixed with Chrysoidine, &c.) for the production of black spirit varnishes and polishes; also in calico printing dissolved in acetin, ethyl tartrate, laevulinic acid, &c., as a substitute for Indigo of good fastness to light and soap.
The oleate or ricinoleate of Induline base is used largely for printing newspapers. Very important dye.

Induline water-soluble,
(AJ) (CR) (CV) (RD)
(W) (GCC) (HM) (SCI)
(LP) (BK) (CJ) (NI)
(tM)
Induline
3B, B, R, crystals, 5B crystals, NT, NBS, BB, BS, E, BE extra, NN, 6B,
L, N, R extra, 5R, greenish, W.
(CAC) (ICA) (CHC)
(LP) (MLy) (StD)
(A) (By) (C) (H)
(MLy) (By) (C) (K)
(tM) (JBS (LBH)
(NAC) (CN) (MC) (StCl)
(StD) (B) (By)

Fast Blue O water-soluble (MLB)—
A bronzy powder.
In water: λ = 587.0.
H_2O: Bluish-violet solution.
Alcohol: Blue solution. HCl to aqueous solution: Bluer solution, and blue precipitate. NaOH: Brownish-violet precipitate. H_2SO_4: Blue solution; violet solution and blue precipitate on dilution.
Dyes wool (Fast Blue brands) and silk (Induline B, R) blue, reddish-blue or bluish-violet from an acid bath; potassium ferrocyanide is added to the bath in dyeing wool.
Level-dyeing 4; relation to cotton 4; relation to silk 4.
Used largely for dyeing silk, leather, jute and paper, and for the manufacture of lakes and inks.
Fast Blue 6B for Wool (A)—
A brown powder.
H_2O: Blue solution.
Alcohol: Blue solution. HCl to aqueous solution: Pure blue solution. NaOH: Reddish-violet solution. H_2SO_4: Pure blue solution, unaltered on dilution. HNO_3: blue.
Dyes wool greenish-blue from a faintly acid bath.

(WDC) Soluble Induline 3B (WSS) Components— Induline spirit-soluble (No. 860) and Sulphonate. No. 861 (699)		
Para Blue, (NI) (*By*) Components— Induline spirit-soluble (No. 860) and *p*-Phenylenediamine. No. 862 (702)	A blue powder. H_2O: Blue solution. λ of 2RX = 589.5. R = 566.0. Alcohol: Blue solution. HCl to aqueous solution: Light blue precipitate. NaOH: Brownish-violet precipitate. H_2SO_4: Blue solution, light blue precipitate on dilution. Dyes cotton, mordanted with tannin and tartar emetic, greyish-blue. Light: 3–4.	
Indophenine (By) Components— Aminoazobenzene-hydrochloride and *p*-Phenylenediamine. No. 863 (701) No longer manufactured.	A dark violet powder. H_2O: Violet-blue solution. Alcohol: Violet-blue solution. HCl to aqueous solution: Bluer solution. NaOH: Violet precipitate. H_2SO_4: Blue solution, unaltered on dilution. Dyes cotton, mordanted with tannin and tartar emetic, blue, rendered darker and fast to light and washing by after-treatment with dichromate.	
Nigrosine spirit-soluble Spirit-Nigrosine, C, G, LM, SG, BN, (BDC) (CV) (JBS) (WSS)(SCH)(S)(T) (BDC)(NAC)(ICA) Components— Aniline, Aniline hydrochloride and Nitro-phenol (or Nitro-benzene and iron). No. 864 (698)	A greyish-black powder. H_2O: Insoluble. λ = **630.5 and:** 578.5, 534.5, 498.5. Many Nigrosines are mixtures. λ: 569.0; 527.0; 491.0 neutral. λ = 641.5; (591.0) (551.0) acid in alcohol. Alcohol: Bluish-black solution. HCl to alcoholic solution: Unaltered. NaOH to alcoholic solution: Reddish-black precipitate. H_2SO_4: Dark green solution; violet solution and then bluish-black precipitate on dilution. Used for the production of the corresponding Nigrosine water-soluble (No. 865) by sulphonation; also (mixed with Chrysoidine, &c.), for the production of black spirit varnishes and polishes, for staining leather, tinfoil, &c.); also in calico printing and silk dyeing in a similar manner to Induline spirit-soluble (No. 860) for fast bluish-grey shades. Light: 3–2. One of the most important Aniline Dyes.	
Nigrosine water-soluble (various brands). Components—	Glistening black lumps. In water: λ = 587.0. H_2O: Bluish-violet solution. Alcohol: Blue solution. HCl to aqueous	

Nigrosine spirit-soluble (No. 864) and Sulphonate. No. 865 (700)	solution: Bluer solution or bluish-black precipitate. NaOH: Brownish-violet precipitate or redder solution. H_2SO_4: Blue solution; violet solution or precipitate on dilution. Dyes wool and silk grey from an acid bath. Level-dyeing, 4; relation to cotton, 4; relation to silk, 4–3. Used mainly for dyeing silk; also formerly for dyeing wool. Light: 3–2.	
Rubramine (*NI*) Components— *p*-Nitrosodimethylaniline hydrochloride, *p*-Toluidine and *o*-Toluidine. No. 866 (703)	A blackish-green powder. H_2O: Magenta-red solution. HCl: Unaltered. NaOH: Red precipitate, soluble in water. H_2SO_4: Green solution; blue solution and then red solution on dilution. Dyes cotton, mordanted with tannin and tartar emetic, reddish-violet, moderately fast to light and soap. Rubramine is suitable for calico printing, and can be used also for dyeing unmordanted cotton and silk. Light: 4.	
Indamine 3R (*NI*) Components— *p*-Nitrosodimethylaniline hydrochloride and *o*-Toluidine hydrochloride. No. 867 (704)	A blackish-grey powder. H_2O:Reddish-violet solution. λ: Not known. Alcohol: Violet-red solution. HCl to aqueous solution: Unaltered. NaOH: Violet precipitate. H_2SO_4: Green solution; blue solution and then red solution on dilution. Dyes cotton, mordanted with tannin and tartar emetic, bluish-violet. Light: 4–5.	
Indamine 6R (*NI*) Components *p*-Nitrosodimethylaniline hydrochloride and *o*- and *p*-Toluidine hydrochlorides. No. 868 (705)	A blackish-green powder. H_2O: Magenta-red solution. λ = not known. HCl: Unaltered. NaOH: Red precipitate. H_2SO_4: Green solution; blue solution and then red solution on dilution. Dyes cotton, mordanted with tannin and tartar emetic, reddish-violet. Light: 4.	
Wool Grey B, G, R, (*MLB*) Components— *p*-Nitrosodimethylaniline and Schäffer's acid; and Aniline (or *p*-Toluidine). No. 869	A black powder. H_2O: Readily soluble. λ: Numerous bands, not characteristic. Alcohol: Moderately soluble. HCl to aqueous solution: Precipitate. NaOH: Brown solution. H_2SO_4: R, blue solution; B, G, yellowish-brown solutions; precipitates on dilution. Dyes wool level reddish: (R), bluish: (B) or yellowish: (G) grey. Light: 3. Used for compound shades.	

On the Fibre— Aniline Black In Substance— Aniline Black Paste (SAPC) Ungreenable Aniline Black— $C_{66}H_{48}N_{11}Cl_3$. No. 870 (922)	*Aniline Black paste—* A black paste, or greenish-black powder on drying. H_2O: Insoluble. λ: Not sharp. Alcohol: Insoluble. Used in printing in admixture with lamp black, albumin and tragacanth thickening, and fixed by steaming. *On the Fibre—* Black from pure aniline, or violet-black from *o*-toluidine. Alcohol: Unaltered. 10% HCl: Unaltered on warming. 5% Na_2CO_3: Unaltered on warming. $SnCl_2$ and HCl (1:1): Dark brown fibre and brown solution on warming. Dyes black, or a single bath black is produced by passing cotton through a bath containing aniline, a mineral acid and sodium dichromate; the cotton is then steamed and soaped at boiling point; hydrochloric acid produces a bluish-black, sulphuric acid a reddish-black, and the mixed acids a jet black. Light: 1–2. Used for dyeing cotton yarn ungreenable black without tendering the fibre, but not fast to rubbing; also in calico printing; also in marking inks. Aged Black or Oxidation Black is produced by padding cotton with a solution containing aniline hydrochloride, an oxidising agent, such as sodium chlorate, and an oxygen carrier, such as copper sulphate or vanadium chloride; the cotton is then dried and aged in a moist atmosphere at a temperature of about 45°, whereby the green colour (Emeraldine) is converted into black (Nigraniline); finally the ungreenable black is developed by chroming, followed by soaping. Copper Aged Black is used mainly for dyeing ordinary and mercerised cotton piece goods, whilst Vanadium Black is used mainly in calico printing. Aged Blacks are liable to tender the fibre to a greater extent than other blacks. Air Oxidation Black is produced by the air oxidation of aniline in presence of a small percentage of a *p*-diamine or of a *p*-aminophenol and an oxygen carrier, such as cuprous chloride, which is kept in solution by the addition of ammonium chloride. The mineral acid used in other processes

can be replaced by an organic acid. After padding, the cotton is dried, aged and chromed as for other Aged Blacks, but tendering of the fibre is avoided.

Steam Black is produced by padding cotton with a solution containing aniline hydrochloride, sodium chlorate and sodium ferrocyanide as oxygen carrier. The cotton is then dried, steamed and chromed.

Steam Black is more expensive than an Aged Black, but is less liable to tender the cotton.

No. 870

Silk may be dyed with Aniline Black in a similar manner to cotton, and this is used mainly for half-silk, such as umbrella cloths.

Aniline Black is also used largely in calico printing for direct printing, and for resist and discharge styles. The amount of Aniline Black on the fibre can be estimated by the determination of the percentage of nitrogen in a sample of the fabric by the Kjeldahl method, as Aniline Black contains 15.5% of nitrogen: (Green).

Important cotton and union black: Seldom met with as powder or paste.

For more details: See Schultz, *Colour Index* and Nölting-Lehne (*Aniline Black:* Springer, Berlin).

On the Fibre—
Diphenyl Black.
p-Aminodiphenylamine-Diphenyl Black Oil DO
(MLB)
Component—
p-Aminodiphenylamine, *o*-Toluidine, Aniline.
No. 871 (922)

Standards are prepared containing—

(a) Diphenyl Black Base, lactic acid, acetic acid, thickening (starch or gum tragacanth) and water.

(b) A copper salt (cupric chloride, or copper sulphide and cerium chloride), aluminium chloride, sodium chlorate, turpentine or olive oil and water.

Dyes cotton, padded in a mixture of the two standards, dried slowly, steamed for 2 minutes in the rapid ager and then soaped, black. Chroming is not only unnecessary, but also renders the shade brown. Light: 1–2.

Diphenyl Black is more expensive than Aniline Black, but is absolutely ungreenable; there is no risk that the fibre may be tendered, and a smaller percentage of base is required to produce a full black shade.

The black prepared from Diphenyl Black Oil DO possesses properties intermediate between those of Aniline Black and Diphenyl Black.

Used also in calico printing, particularly for the prodution of fast black on

	β-naphthol prepared calico which is to be developed subsequently with a diazo-compound. Diphenyl Black Base is used for the most delicate steam styles, and Diphenyl Black Oil DO is used for the more ordinary black and white effects. This dye is much used.	
Durophenine Brown (*CAC*) Components— *p*-Nitrosophenol and dilute Sulphuric acid. No. 872	A black powder. H_2O: Insoluble; soluble in aqueous alkalies or sodium sulphide. HCl to alkaline solution: Blackish-brown precipitate. H_2SO_4: Violet-black solution, dark brown precipitate on dilution. Dyes cotton from a sodium sulphide bath dark violet-brown, rendered particularly fast to washing by after-treatment with dichromate or copper sulphate. Light: 2. Scarcely used.	
Methylene Grey, ND, NFD, NFSt, O, (CCC) (MLB) Silk Grey O Fast to Water, (MLB) Component— *p*-Nitrosodimethylaniline hydrochloride. No. 873 (681)	A greyish-black powder. H_2O: reddish-grey solution. λ: not sharp. Alcohol: Reddish-grey solution. HCl to aqueous solution: Greyish-blue solution. NaOH: Greyish-black precipitate of the colour-base, soluble in benzene or ether with a cherry-red colour; a fine bluish-green aqueous extract is obtained by the addition of water or dilute acetic acid to this solution. H_2SO_4: Greenish solution; reddish-grey solution on dilution. Dyes cotton direct, or cotton mordanted with tannin and tartar emetic, silver-grey to blackish-grey. Hard water should not be used. Light: 2. *Methylene Grey O*— Used also in calico printing and for dyeing half-silk with Cr-salts. Very cheap waste product from Gallamine.	
Nigramine (*NI*) Components— Aniline hydrochloride and *p*-Nitrosodimethylaniline hydrochloride. No. 874 (682)	A black powder. H_2O: Bluish-violet solution. Alcohol: Bluish-violet solution. HCl to aqueous solution: Unaltered. NaOH: Violet precipitate. H_2SO_4: Greyish-green solution; bluish-violet solution on dilution. Dyes cotton, mordanted with tannin and tartar emetic, bluish-grey. Not manufactured.	
p-Phenylenediamine— Furrein D (SCI)	Paramine Brown— Dyes cotton, brown after padding with *p*-phenylenediamine, sodium chlorate, ammonium chloride and ammonium vanadate, and then dried, steamed,	

Fouramine D
(StD)
Ursol P
(A)
Components—
p-Phenylenediamine, or *p*-Aminophenol, or Diaminodiphenylamine, and Oxidising agents (*e. g.* Hydrogen Peroxide, Potassium dichromate, &c.).
No. 875 (923)

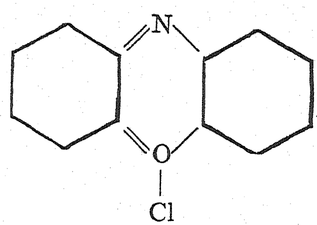
rinsed and soaped.
Dyes pelts, from a bath containing 1–10 grm. of the base per litre, ammonia or formic acid, and hydrogen peroxide at 25–30°.
Used for dyeing fur, feathers and hair brown to black. *p*-Phenylenediamine and *p*-aminophenol, alone or in admixture, are used in calico printing for the production of brown to olive shades. *p*-Phenylenediamine is also used for the development of certain direct cotton colours after diazotisation on the fibre. Light: 2. Always made on the fibre.
p-*Amino*-phenol, brown; *o*-*Amino*-phenol, orange-brown; Diamino-Diphenylamine, dark-brown to black.

OXAZINE COLOURING MATTERS

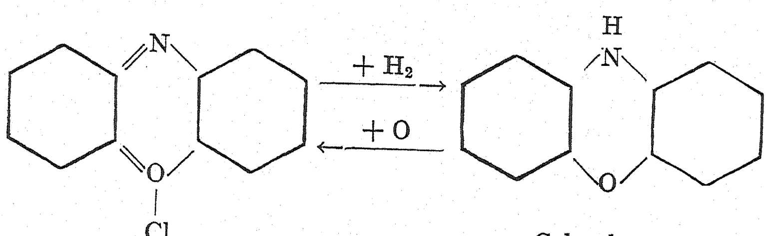
No. 876–919

Oxazine Colouring Matters

Oxazines contain the Group:



This grouping has very similar properties to the azine Grouping. It is reduced by mild reducing agents to the leuco compound:



Colourless.

This reduction, as a rule, takes place even more readily than the corresponding reduction of the azines. Reoxidation is, however, effected with less ease, but very often it is not easy to distinguish between azines and oxazines by chemical reactions. In most cases

the spectroscope at once differentiates them. Some of these dyestuffs, namely, most of the basic members, dye acetate silk (Celanese) easily, being absorbed from weakly acid baths in the form of the free bases.

Oxazines are used for dyeing wool, cotton, and silk, but some of them, such as Meldola's Blue, are used in large quantities, in combination with Vesuvin and Chrysoidine, for dyeing leather.

Capri Blue GON V, (By) (L) (L) Zinc double chloride of dimethyl-diethyl-diamino-methyl-diphenazoxonium chloride. No. 876 (620)	Glistening green crystals. In water: λ = 665.5 and 606.7. H_2O: Blue solution. Alcohol: Blue solution. HCl to aqueous solution: Red solution. NaOH: Unaltered. H_2SO_4: Green solution when in thin layers, or red solution when in thick layers; red solution on dilution. Dyes cotton, mordanted with tannin and tartar emetic, greenish-blue, fast to light and washing, and moderately fast to chlorine. Used for dyeing cotton and linen, for coloured discharges in calico printing, and to a less extent for dyeing silk, half-silk and acetate-silk. Light: 2–3. Capri Blue is exceptionally fast to light when dyed direct on acetate-silk. *Capri Green 2GN*— H_2O: Blue solution. HCl: Reddish-brown solution. NaOH: Unaltered. H_2SO_4: Reddish-brown solution, rendered paler without change of colour on dilution. Dyes cotton, mordanted with tannin and tartar emetic, green.	
Delphine Blue B, *(AAP) (S) (By)* Ammonium salt of the sulphonic acid of dimethylamino-phenyl-amino-hydroxy-diphenoxazone. No. 878 (622)	An olive-brown powder or dark paste; the paste is the insoluble free sulphonic acid. In water: Delphine Blue B (By): λ = about 543.5. H_2O: Bluish-violet solution. HCl: Redder solution and dark flocculent precipitate. NaOH: reddish-precipitate. H_2SO_4: Reddish-violet solution, dark blue precipitate on dilution. Dyes chrome-mordanted wool indigo-blue, moderately fast to light and milling; the spot with nitric acid is similar to that of Indigo. Light: 3. Used also in calico printing with a chromium mordant.	
Brilliant Cresyl Blue BB, *(L)*	*Cresyl Blue BBS*— A green powder.	

Amino-diethylamino-methyl-diphenazoxonium chloride. No. 877 (621)	In water: $\lambda = 631.8$ and 577.5. H_2O: Blue solution. HCl: Dark brown solution. NaOH: Brown precipitate. H_2SO_4: Dichroic solution (green by reflected light and violet-red by transmitted light); brown solution on dilution. Dyes cotton, mordanted with tannin and tartar emetic, blue, fast to light and washing. Light: 2–3. Used particularly in calico printing for tannin discharge effects, as it yields a pure white; also for coloured discharges, as it is unaffected by hydrosulphite NF; also for dyeing acetate silk. Cresyl Blue is exceptionally fast to light when dyed direct on acetyl silk.
Gallophenine GD (By) Sodium salt of the sulphonic acid of dimethyl- (or diethyl-) amino-phenylamino-hydroxy-diphenoxazone. No. 879	Chromazurine E— A dark powder with a bronzy lustre. H_2O: Deep blue solution. λ: Not sharp. λ for brand S = 618.9 [568.2]. Alcohol: Violet solution. HCl to aqueous solution: olive-green solution, green precipitate on standing. Acetic acid: Green solution. NaOH: Violet solution. H_2SO_4: Wine-red solution, unaltered and then rather browner solution on dilution. Dyes chrome-mordanted wool blue which approaches Methylene Blue (No. 922) in shade. Light: 2–3. Used also in calico printing with a chromium mordant.
Pyrogallolcyanine sulphonic acids (DH) Sodium salt of the sulphonic acid of di-alkylamino-hydroxy-diphenoxazone No. 880 (623)	A blackish-violet powder. H_2O: Violet-blue solution. λ: ca. 590.0. HCl: Red solution and precipitate on standing. NaOH: Unaltered. H_2SO_4: Blue solution; red to violet solution on dilution. Dyes chrome-mordanted wool violet to blue. Light: 2–3.
Modern Violet N **(DH)** Hydrochloride of the leuco-compound of a decarboxylated Gallocyanine. No. 881 (624)	A dark greyish-green powder. In water: $\lambda = 642.1$ and 548.5. H_2O: Blue solution. HCl: Violet-red solution. NaOH: Oxidised to a dark violet-red solution. H_2SO_4: Pale brownish-violet solution (which becomes blue on adding manganese dioxide), reddish-solution on dilution. Dyes chrome-mordanted fabrics violet, the chrome lakes being readily developed by steaming, and cotton mordanted with tannin and iron or aluminium. Used in dyeing and in printing.

	Discharged white by chlorate and yellow prussiate on cotton. One of the most important violets for printing.	
Modern Heliotrope DH *(DH)* Hydrochloride of the leuco-compound of the amide of methylamino-hydroxy-carboxy-methyl-diphenoxazone. No. 882 (625)	A pale greyish-yellow to greyish-red powder. H_2O: Pale green solution. λ: points to a mixture HCl: Pale red solution. NaOH: Oxidised to a turbid violet-red solution. H_2SO_4: Pale violet-red solution (which becomes violet-blue on adding manganese dioxide); pale yellowish-red solution on dilution. Dyes chrome-mordanted cotton reddish-violet. Light: 2–3. Used mainly in calico printing with chromium acetate.	
Gallocyanine W, DH, SR paste and pdr., F paste and pdr. liquid, pdr. (AAP) (GCC) (S) (SCI) (B) (By) (C) (DuP) (DH) (SCI) (SCI) (B) (By) Dimethylamino-hydroxy-carboxy-diphenoxazone. No. 883 (626)	The base is a green crystalline paste, and the hydrochloride is a green powder. *Gallocyanine F:* (B): $\lambda = 635.4$. H_2O: Insoluble. Alcohol: Sparingly soluble with a bluish-violet colour. HCl to the paste: Pale magenta-red solution. NaOH: Reddish-violet solution. H_2SO_4: Cornflower-blue solution, magenta-red solution on dilution. Dyes chrome-mordanted wool and cotton bluish-violet, and cotton mordanted with tannin and iron or aluminium. Used in printing chrome-mordanted wool and cotton; also, in conjunction with logwood, for dyeing chrome-mordanted wool inexpensive and bright navy shades, moderately fast to light. Light: On wool; 3–4; on cotton; 3–2. Discharged white by chlorate and yellow prussiate on cotton, but not by hydrosulphite. **Very important printing colours.**	
Anthracyanine BGG pdr., S pdr., SR pdr. (DH) Gallo Navy Blue S pdr. (By) Components— Gallocyanines and Alkylated *p*-diamines containing a primary amino-	A blackish-green powder. Modern Cyanine (DH): $\lambda = 662.9$. H_2O: Pale bluish-green solution. HCl: Pale reddish-brown solution. NaOH: Oxidised to a violet solution. H_2SO_4: Pale reddish-brown solution (which becomes violet on adding managanese dioxide), brownish solution on dilution. Dyes chrome-mordanted cotton greenish-blue. Light: 2–3. Used mainly in calico printing with a chromium mordant. Discharged white by chlorate and yellow prussiate on cotton.	

group. No. 884 (627)	
Gallocyanine MS pdr. (DH) A Gallocyanine sulphonic acid. No. 885 (628)	A black powder. H_2O: Blue solution. λ = 647.5. HCl: Wine-red solution. NaOH: Violet solution. H_2SO_4: Bluish-violet solution; reddish-violet solution and then wine-red solution on dilution. Dyes chrome-mordanted wool blue, fast to washing. Light: 3–4.
Gallo Green (DH) Modern Blue (*DH*) Components— Gallocyanines and Formaldehyde. No. 886 (629)	A dark greyish-green powder. H_2O: Green to brownish-solution. λ: Mixtures of blue and green. HCl: Pale reddish-solution. NaOH: Oxidised to a reddish-violet solution. H_2SO_4: Pale brownish-violet solution; reddish solution on dilution. Dyes chrome-mordanted cotton green to dark blue. Light: 2–3. Used particularly in calico printing.
Cyanazurine (*DH*) Components— Arylated Gallocyanines, reduced. No. 887 (630)	A green powder. H_2O: Pale yellowish-green solution. λ = ca. 605.0. Alcohol: Pale blue solution. HCl to aqueous solution: brownish-precipitate. NaOH: Oxidised to a dark blue solution. H_2SO_4: Brownish-yellow solution, brownish-red precipitate on dilution. Dyes chrome-mordanted cotton greenish-blue. Light: 3. Used particularly in calico printing.
Brilliant Gallocyanine (DH) **Chromocyanine V, B paste,** (DH) Chromoglaucine BMJ (**MLB**) Sulphonic acids of leuco-Gallocyanines. No. 888 (631)	*Chromocyanine V*— A dark paste. H_2O: Violet solution. λ = 665.0, 604.0; in alcohol: 614.0. HCl: Reddish-violet precipitate. NaOH: Redder solution, converted into blue on exposure to air. H_2SO_4: Dark violet solution; reddish-violet solution on dilution. Dyes chrome-mordanted wool and cotton bright violet of good fastness. *Brilliant Gallocyanine*— A greenish-grey paste. In water: λ = 640.4, [592.2] and [548.5]. NaOH: Brown solution, converted into deep blue on exposure to air. H_2SO_4: Pale brownish-red dichroic solution, converted into blue by oxidising agents. Dyes chrome-mordanted wool and cotton bright blue of good fastness. Light: 3. Used mainly in calico printing; also for dyeing wool. Discharged white by chlorate and

	yellow prussiate on cotton, but not by hydrosulphite or rongalite.
Ultra Violet LGP (*S*) Components— *A Gallocyanine and a leuco-Gallocyanine.* No. 889 (632)	A brownish-black powder. H_2O: Violet-blue solution. λ = ca. 625.0. Alcohol: Blue solution. HCl to aqueous solution: violet solution. NaOH: Reddish-violet solution. H_2SO_4: Blue solution; red solution on dilution. Dyes chrome-mordanted wool and cotton violet of good fastness to light, washing and chlorine in the latter case, and cotton, mordanted with tannin and iron or aluminium. Used in calico printing with chromium acetate, and a slightly bluer shade is obtained in presence of a trace of hydrosulphite or tannic acid. Light: 3. Discharged white by chlorate and yellow prussiate on cotton, but not by hydrosulphite.
Indalizarine J, R (**DH**) Gallo Indigo Blue H, HB (**By**) Components— Sulphonated Gallocyanines and sodium sulphite. No. 890 (633)	A paste. In water: λ = about 669.3. H_2O: Olive solution. NaOH: Brown solution, oxidised by air to a bluish-violet solution. H_2SO_4: Pale Bordeaux-red to violet dichroic solution. Dyes chrome-mordanted wool and cotton reddish-blue of good fastness. Light: 3–2. Used in dyeing and printing.
Indalizarine Green (*DH*) Nitrogallocyanine sulphonic acid. No. 891 (634)	H_2O: Insoluble. λ: not sharp. H_2SO_4: Dark reddish-violet solution. Dyes chrome-mordanted wool fast green. (3–2.)
Chromazol Violet paste, (BDC) Modern Violet pdr. (LBH) (DH) Gallo Violet DF pdr. (By) Hydrochlorides of various leuco-Gallocyanines. No. 892 (635)	A dark powder. H_2O: Pale greenish-blue solution. Oxidised: λ = 651.0 in H_2O; 618.0 in alcohol, identical with gallamine blue. HCl: Violet solution. NaOH: Rapidly oxidised to a bluish-violet solution. H_2SO_4: Pale red dichroic solution, converted into blue by oxidising agents. Dyes chrome-mordanted wool and cotton violet to blue, fast to light, washing and chlorine in the latter case, and cotton mordanted with tannin and iron or aluminium. Light: 2 on Cotton. Used in dyeing and in calico printing. Discharged white by chlorate and yellow prussiate on cotton, but not by hydrosulphite, and is used there-

	fore with the latter for coloured discharges with Para Red (No. 44), and as a reserve under Aniline Black (No. 870). Printed with chromium acetate, it is steamed and then developed by passing through a bath of dichromate rendered alkaline with soda. *Modern Violet pdr.* (DH) possesses a high direct affinity for acetate silk, and the shades produced are very satisfactory on this fibre. A very important printing violet.
Prune pure, O, (BDC) (S) (SCI) (S) Gallo Blue E (By) Components— Methyl gallate and *p*-Nitrosodimethylaniline hydrochloride. No. 893 (636)	Brown glistening crystals, dark brown powder or paste. In water: *Prune pure* (*S*): $\lambda = 650.75$ and 594.8. H_2O: Readily soluble with a reddish-violet colour. Alcohol: Bluish-violet solution. HCl to aqueous solution: Magenta-red solution. NaOH: Brown precipitate, soluble in excess to a violet solution. H_2SO_4: Cornflower-blue solution; magenta-red solution on dilution. Dyes cotton mordanted with tannin and tartar emetic, or mordanted with tannin and iron or aluminium, or chrome-mordanted cotton or wool, bluish-violet, moderately fast to light and washing. Light: 3. Cotton mordanted with an aluminium salt is dyed from a very faintly alkaline bath. Used mainly in calico printing. Discharged white by chlorate and yellow prussiate on cotton, but not by hydrosulphite.
Gallamine Blue, paste, (BDC) (SCI) (Gy) (By) Bisulphite compound of the amide of dimethylamino-hydroxy-carboxy-diphenoxazone. No. 894 (637)	A light grey paste. In water: $\lambda = 650.75$. H_2O: Greenish solution, hot. HCl: Wine-red solution. NaOH: Reddish-violet solution, red flocculent precipitate on dilution. H_2SO_4: Red solution (green in thin layers); wine-red solution on dilution. Dyes wool, mordanted with dichromate and tartar, bluish-violet, partially discharged by soap or acids, and of only moderate fastness to light. Light: 3–4. Used with chromium acetate in calico printing and for compound shades in wool dyeing and in calico printing.
Aminogallamine Blue (*DH*) Probably, the hydrochloride of the leuco-	H_2O: Brownish-red solution. $\lambda =$ about, 605.0. HCl: unaltered. NaOH: Oxidised, with formation of a greyish-blue precipi-

compound, of the amide of amino-dimethylamino-hydroxy-carboxy-diphenoxazone. No. 895 (638)	tate. H_2SO_4: Brownish-red solution, unaltered on dilution. Dyes chrome-mordanted wool and cotton blue. Light: 3. Used mainly in calico printing.
Gallanil Violet B, R (*DH*) Gallanil Violet R, B- Anilide of dimethyl- (or diethyl)-amino-dihydroxy-carboxy-diphenazoxonium chloride. No. 896 (639)	Gallanil Violet BS— A black paste. H_2O: Sparingly soluble with a blue colour. Alcohol: Very sparingly soluble with a blue colour. HCl to aqueous solution: Reddish-violet precipitate. NaOH: bright bluish-violet solution. H_2SO_4: Greyish-red solution, dull claret precipitate on dilution. Dyes wool blue from an acid bath, and chrome-mordanted wool and silk violet. Light: 3.
Gallanil Indigo P (**DH**) Probably, the anilide of dimethyl- (or diethyl-) aminophenylamino-dihydroxy-carboxy-diphenazoxonium chloride. No. 897	Gallanil Indigo PS— A blue paste with a coppery reflex. H_2O: Indigo-blue solution (Gallanil Indigo P is insoluble). $\lambda = 597.5$; in alcohol; 581.0. HCl: Dark brown precipitate. NaOH: bluish-violet solution. H_2SO_4: brownish-violet solution, brown precipitate on dilution. Dyes chrome-mordanted fabrics indigo-blue; Gallanil Indigo PS also dyes silk and wool indigo-blue from an acid bath. Light: 3.
Gallanil Green (*DH*) Components— Gallanil Indigo PS (No. 897) and nitrate. No. 898	A dark brown paste or bronzy powder. H_2O: Bluish-green solution. HCl: Dark blue precipitate. NaOH: Violet solution, bluish-green precipitate with excess. H_2SO_4: Crimson-red solution, brown precipitate on dilution. Dyes chrome-mordanted wool green. Light: 3–4.
Modern Azurine DH (*DH*) leuco-compound of the methyl-ester of dimethylamino-dihydroxy-carboxy-diphenoxazone. No. 899 (640)	A greenish-yellow powder. H_2O: Readily soluble, with a yellow colour. λ = ca. 608.0. HCl: Unaltered. NaOH: Oxidised to a blue solution. H_2SO_4: Green solution; yellow solution on dilution. Dyes chrome-mordanted fabrics bright blue. Used also in printing. Light: 3–4. Discharged white by chlorate and yellow prussiate on cotton.
Corein 2R pdr. (**DH**) Celestine Blue B (**S**) (**By**) Amide of diethyl-	*Celestine Blue:* Greenish-black powder; *Coreine* 2R: A thin brown paste. In water: $\lambda = 654.45$, 600.20 and 552.60. H_2O: Reddish-violet solution, or blue solution on great dilution. Alcohol: Blue solution. HCl to aqueous

amino-dihydroxy-carboxy-diphen-azoxonium chloride. No. 900 (641)	solution: Magenta-red solution. NaOH: Bluish-violet solution, which becomes redder at the edges, and violet precipitate. H_2SO_4: Cornflower-blue solution; magenta-red solution on dilution. Dyes chrome-mordanted wool bluish-violet, moderately fast to light, milling, acids and alkalies, or chrome-mordanted cotton, or cotton mordanted with tannin and iron or aluminium. The shade is brighter than that of Gallamine Blue (No. 894). Light: 3–2. Used also in calico printing with chromium acetate, in wool printing and for dyeing acetyl silk direct. Discharged white by chlorate and yellow prussiate on cotton.	
Ultracyanine B, R (S) Zallozol blue (Gy) Components— Gallocyanine (No. 883) and resorcinol (No. 902). No. 901 (644)	*Ultracyanine B*— H_2O: Yellowish-green solution. Alcohol: Yellowish-green solution. HCl to aqueous solution: Colourless or faintly yellow solution. NaOH: Colourless solution, rapidly oxidised to blue solution. H_2SO_4: Colourless solution; colourless or faintly yellow solution on dilution. Dyes chrome-mordanted wool or cotton blue. *Ultracyanine R*— H_2O: Pale blue solution. Alcohol: Pale blue solution. HCl to aqueous solution: Colourless or faintly yellow solution. NaOH: Violet solution. H_2SO_4: Pale blue solution, colourless or faintly yellow solution on dilution. Dyes chrome-mordanted wool or cotton violet. Light: 3.	
Phenocyanine VS, V, R, (DH) Gallophenine VS (By) Components— Gallocyanines and resorcinol. No. 902 (642)	A greenish-yellow paste or greenish solution. In water: *Phenocyanine VS (DH)*: λ = about 670.0. H_2O: Readily soluble. Alcohol: Sparingly soluble. HCl to aqueous solution: Soluble green precipitate, dirty grey solution with excess. NaOH: Brown solution, rapidly oxidised to a blue solution. H_2SO_4: Pale brown solution, oxidised slowly to a blue solution. Dyes chrome-mordanted wool and cotton indigo-blue, fast to light, washing, milling, acids and alkalies; duller shades are obtained by after-chroming. Light: 3–2. Used mainly in calico printing.	

Phenocyanine TC (*DH*) Component— Phenocyanine VS (No. 902) No. 903 (642)	H_2O: Sparingly soluble. λ = about 902. NaOH: Blue solution. H_2SO_4: Blue solution. HNO_3: *id.* Dyes chrome-mordanted cotton fast blue (cf. Phenocyanine VS, No. 902).	
Phenocyanine TV (DH) Gallophenine TV (*By*) **Components—** Phenocyanine TC (No. 903) and Sulphonate. No. 904 (643)	A dark blue powder with a bronzy lustre. H_2O: Blue solution. HCl: Reddish-violet solution and precipitate. NaOH: violet-solution. H_2SO_4: Blue solution; reddish-violet solution and precipitate on dilution. HNO_3: *id.* Dyes wool and silk from an acid bath, or chrome-mordanted wool and silk, and chrome-mordanted cotton blue. Used in calico printing with chromium acetate; also in printing wool and silk with or without a mordant. Light: 3.	
Gallazine A (DH) Gallo Blue GAW, (By) Lanoglaucine W (*MLB*) Components— Gallocyanines and Schäffer's acid. No. 905 (645)	A black paste. In water: λ = 644.5 and 594.8. H_2O: Blue solution. HCl: Precipitate and red coloration. NaOH: Violet solution. H_2SO_4: Blue solution, violet precipitate and violet solution on dilution. Dyes chrome-mordanted wool indigo-blue, moderately fast to light, milling, washing, acids and alkalies; duller shades, faster to milling, are obtained by after-chroming. Light: 3. Used mainly in calico printing.	
Coreïne AB, ABN, AR (DH) Celestine Blue ABN (By) Components— Coreïne 2R (No. 900) and Aniline; and Sulphonate. No. 906 (646)	A black paste. H_2O: Blue solution. λ: Not known. HCl: *AB*, violet-brown precipitate; *AR*, reddish-violet precipitate. NaOH: Redder solution. H_2SO_4: Reddish-violet solution; carmine-red solution and precipitate on dilution. Dyes chrome-mordanted wool and cotton greenish-blue, moderately fast to light, washing, milling, acids and alkalies, and cotton mordanted with tannin and iron or aluminium. The shade of *Coreïne AB* is slightly greener than that of *Coreïne AR*. Used mainly in calico printing. Light: 3. Discharged white by chlorate and yellow prussiate on cotton.	
On the fibre— Nitroso Blue MR (MLB) Resorcine Blue (*MLB*) Tannin lake of dimethylamino-diphenoxazone.	*On the Fibre—* H_2SO_4 (conc.): The pattern darkens and the solution is blue. H_2SO_4: (dilute): Unaltered. HCl (conc.): Unaltered. HNO_3: Unaltered. $SnCl_2$ and HCl: The pattern is decolorised. NaOH: The pattern becomes brown.	

No. 907 (647)	Ammonia: The pattern is scarcely altered, but the solution is brown. Dyes cotton padded with a mixture of resorcinol, *p*-nitrosodimethylaniline and tannin, steamed and passed through a bath of tartar emetic, indigo-blue, moderately fast to light and washing. Formerly used in calico printing. No longer used. Calico is padded with an alkaline solution of resorcinol, dried and printed with *p*-nitrosodimethylaniline and tannin in presence of acetic acid or oxalic acid; it is then steamed and passed through a tartar emetic bath. Light: 4.
Iris blue (B) (S) Resorcine Blue (SCI) Ammonium salt of tetra bromo-resorufin, or of tetrabromo-hydroxy-diphenoxazone. No. 908 (648)	A thin brownish-red paste containing small green crystals. In alcohol: λ = 608.7, 589.1, 567.0, 559.2 and 541.5. H_2O: Reddish-violet solution with a green fluorescence on boiling. HCl: Yellowish-brown precipitate. NaOH: Unaltered; the solution is decolorised rapidly on adding zinc dust, and is reoxidised by air to a blue solution. H_2SO_4: Blue solution (with the dry colour), violet solution and then reddish-brown precipitate on dilution. HNO_3: *id.*, decomposition. Dyes silk, from a boiled-off liquor bath rendered faintly acid with acetic acid, moderately bright bluish-violet with a brownish-red fluorescence, (particularly noticeable in gaslight), fast to light, washing and acids. Light: 3. Used also to a limited extent for dyeing wool.
Meldola's Blue Meldoline Blue (BSS) Naphthol Blue 3R R, D, (AAP) (C) (R) (tM) R Naphthylene Blue R cryst. (By) Dimethylamino-naphtho-phenazoxonium chloride, or its zinc	A dark violet bronzy glistening powder, the dust of which exerts an extremely irritant action on the mucous membrane. In water: *New Blue R* (By): λ = 622.3, 573.25 and 533.4. H_2O: Readily soluble with a bluish-violet colour. Alcohol: Blue solution. HCl to aqueous solution: Bluer solution. NaOH: Brown flocculent precipitate. H_2SO_4: Blackish-green solution; blue solution on dilution. Dyes cotton, mordanted with tannin and tartar emetic, indigo-blue. Used largely as a substitute for Indigo and for topping vat blues. Light: 4.

double chloride. No. 909 (649)	Unsuitable for dyeing silk and wool, but very suitable for discharge effects on cotton mordanted with tannin. *Note:* The dust provokes sneezing.
Basic Blue for leather **N2B** (CN) Fast Navy Blue G, BM, GM, (GrE) (K) Fast Cotton Blue B **(GrE) (MLB)** Dimethylamino-*p*-dimethylamino-phenyl-amino-naphthophenazoxonium chloride. No. 910 (650)	A dark violet powder, the dust of which exerts an extremely irritant action, **causing sneezing.** In water: *New Blue B (SCI)*: λ = 623.9, 574.5 and 534.8. H_2O: Readily soluble with a blue colour. Alcohol: Blue solution. HCl to aqueous solution: Dirty violet solution. NaOH: Brown precipitate, soluble in ether. H_2SO_4: Dirty green solution; dirty violet solution, and then blue solution on dilution. Dyes cotton, mordanted with tannin and tartar emetic, a bluer shade than Meldola's Blue (No. 909). Used in cotton dyeing alone, or for compound shades with other basic dyes; also for dyeing leather. Light: 4–3.
New Methylene Blue NGG GG, **(MLy) (C)** Tetramethyldiamino-naphthophenazoxonium-chloride. No. 911 (651)	A greenish-grey powder. In water: *New Methylene Blue GG* (C): λ = 663.0 and 604.4. H_2O: Blue solution. Alcohol: Greenish-blue solution. HCl to aqueous solution: Green solution. NaOH: Green precipitate. H_2SO_4: Reddish-brown solution; brown solution, and then pure blue solution on dilution. Dyes cotton, mordanted with tannin and tartar emetic, greenish-blue, fast to light and washing, and silk from an acidified boiled-off liquor bath a beautiful blue, moderately fast to light, and rendered very fast to washing by after-treatment with tannin and tartar emetic. Light: 3–4. Used also for colouring microscopic sections. Nitrogenous matter is coloured blue, whilst neutral fat is stained red. The red colour is due to partial hydrolysis of New Methylene Blue GG, whereby the red dimethylamino-naphthophenoxazone is formed. *New Fast Blue F, H*—
New Fast Blue F, H, (By) New Indigo Blue F, R, *(By)* Zinc double chloride of dimethyl-amino-	A dark brown powder or black-blue paste. H_2O: F, blue solution; H, violet solution. λ: [627.0] 576.0 536.0. F: mixture. HCl: Redder solution. NaOH: Dark flocculent precipitate. H_2SO_4: Green-

tetra methyldiamino-diphenylmethane-naphthophenazoxonium chloride. No. 912 (652)	ish-blue solution; blue or violet solution on dilution. *New Indigo Blue F, R*— A Blue paste. H_2O: blue solution. HCl: Green solution. NaOH: Dark flocculent precipitate. H_2SO_4: Greenish-blue solution; green solution on dilution. Dyes cotton, mordanted with tannin and tartar emetic, greenish-blue (F brands) or reddish-indigo-blue (R brands), fast to acids and moderately fast to light, washing and alkalies. Light: 4.
Nile Blue A (B) (By) **Diethylamino-amino-naphtho-phenazoxonium sulphate.** No. 913 (653)	A green crystalline powder with a bronzy lustre. In water: $\lambda = 644.5$ and 592.2. H_2O: Sparingly soluble, cold; readily soluble, hot, with a blue colour. Alcohol: Blue solution. HCl to aqueous solution: Separation of the hydrochloride in fine needles, which appear violet by transmitted light and green by reflected light. NaOH: Red precipitate, soluble in ether with a brownish-orange colour and a green fluorescence. H_2SO_4: Brownish-solution; green solution and then blue solution on dilution. Dyes cotton, mordanted with tannin and tartar emetic, bright blue, fast to chlorine, acids and alkalies, and moderately fast to light and washing. Unsuitable for dyeing wool, but used for dyeing silk. Light: 3–4. Used also for colouring microscopic sections. Nitrogenous matter is coloured blue, whereas neutral fat is stained red. The red colour is due to partial hydrolysis of Nile Blue A, whereby the red diethyl-amino-naphthophenoxazone is formed. *Nile Blue B*— A greenish-black powder. H_2O: Blue solution. Alcohol: Blue solution. HCl to aqueous solution: Yellowish-green solution. NaOH: Light red precipitate. H_2SO_4: Brownish-red solution; green solution on dilution. HNO_3: *id.* Dyes cotton, mordanted with tannin and tartar emetic, greenish-blue.
Nile Blue 2B **(B)** Diethylamino-benzylamino-naphtho-	A crystalline powder with a metallic lustre. In water: $\lambda = 656.7$ and 600.2.

phenazoxonium chloride. No. 914 (654)	H_2O: Sparingly soluble cold, more readily soluble hot, with a greenish-blue colour. Alcohol: Readily soluble with a greenish-blue colour. HCl to aqueous solution: Green iridescent crystalline precipitate. NaOH: Brownish-red precipitate, soluble in ether with an orange-yellow colour and a green fluorescence. H_2SO_4: Brownish-red solution; green solution and then blue solution on dilution. Dyes cotton, mordanted with tannin and tartar emetic, a beautiful greenish-blue, much greener than Nile Blue A (No. 913), but of inferior fastness to alkalies. Light: 4–3. Nile Blue 2B is so sensitive to alkalies that it may be used for testing the resisting power of glass.
Muscarine Dimethylamino-hydroxynaphtho-phenazoxonium chloride. (*DH*) No. 915 (655)	A brownish-violet powder. In water: $\lambda = 630.45$, 575.75 and 536.60. H_2O: Sparingly soluble cold, readily soluble hot, with a bluish-violet colour. HCl: Bluish-violet precipitate. NaOH: Yellowish-brown solution. H_2SO_4: Bluish-green solution; blue solution, violet solution and then violet precipitate on dilution. Dyes cotton, mordanted with tannin and tartar emetic, moderately fast reddish-blue. Used, but only to a small extent, in calico printing. Light: 4–3.
Fast Green M (*DH*) Probably, dimethyl-aminophenyl-amino-hydroxy napthophen-azoxonium chloride. No. 916	A coppery-brown powder. H_2O: Sparingly soluble. In alcohol: $\lambda = 651.0$, distinct band in green. Alcohol: Insoluble. Acetic acid: Greenish-blue solution. HCl (conc.): Yellowish-brown solution. H_2SO_4: Brownish-violet solution; orange solution on dilution. Used in calico printing with tannin for green shades, fast to light. (3–4.)
Alizarine Green G, (*GCC*) (*WDC*) Dihydroxy-dinaph-thazoxonium sul-phonate. No. 917 (656)	A brownish-black powder. H_2O: Sparingly soluble cold, more readily soluble hot with a greyish-green colour. λ: Not sharp, about 495.0. HCl: Bordeaux-red solution and crystalline precipitate. NaOH: Brownish-violet precipitate. H_2SO_4: Bluish-green solution; blue solution, violet solution and then bluish-red precipitate on dilution. Dyes chrome-mordanted wool, from a weak acetic acid bath, green, rendered

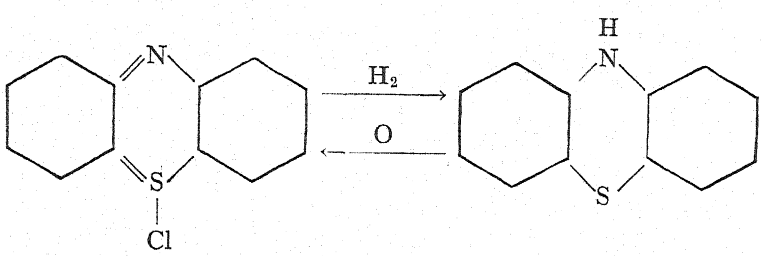
	bluer and faster to milling by working in dilute ammonia. Light: 3. A blackish-green powder.	
Alizarine Green B (*WDC*) Dihydroxy-dinaphthazoxonium sulphonate. No. 918 (657)	H_2O: Green solution. λ = about 560.0. HCl: Red crystalline precipitate, partially soluble on boiling. NaOH: Green flocculent precipitate. H_2SO_4: Dull bluish-violet solution; yellowish-green solution and then red precipitate on dilution. Dyes chrome-mordanted wool from a weak acetic acid bath green, rendered bluer and faster to milling by working in dilute ammonia. Light: 3.	
Fast Blue-Black paste (*L*) Components— *m*-Hydroxydiphenylamine- and *p*-Nitrosodimethylaniline hydrochloride. No. 919 (658)	A black paste or powder. H_2O: Violet-black solution. λ: not sharp. Alcohol: Bluish-black solution. HCl to aqueous solution: Bluish-black precipitate. NaOH: Violet-black precipitate. H_2SO_4: Black solution; violet-blue solution and precipitate on dilution. Dyes cotton, mordanted with tannin and tartar emetic, blue-black, fast to light, alkalies, soap and acids. A deep black of very good fastness is obtained on a mordant of sumach and iron. Light: 3–2.	

THIAZINES

No. 920–932

Thiazines

Thiazines form an interesting small Group of dyes, having the Group:



Phenaz-thionium-chloride

Thio-diphenylamine

This Group may be reduced by weak reducing agents, giving the colourless *leuco compounds*. Thiazines can be very readily identified, owing to the presence of sulphur, by the ordinary analytical reac-

tions. The Absorption Spectra are very characteristic, as well as the red fluorescence which distinguishes most of the members of the group.

The only really important Thiazine Dyestuff is Methylene Blue, whilst the other members of the group are used to a limited extent for printing and dyeing cotton. Silk is usually dyed black with Methylene Blue in combination with Prussian Blue, Cachou and Chrysoidine. Bismarck Brown and Chrysophenine are also frequently used to shade the different blacks. Logwood is also usually shaded with Methylene Blue, but some dyers prefer Methylene Green.

Lauth's Violet *Thionine* Diamino-diphenazthionium chloride. No. 920	A blackish-green powder with a metallic lustre, which crystallises in glistening needles. H_2O: Sparingly soluble cold, violet solution hot. $\lambda = 602.5$ and [559.5]. HCl: Somewhat bluer solution. NaOH: Brownish-red precipitate. H_2SO_4: Yellowish-green solution; blue solution and then violet solution on dilution. HNO_3: Green. Dyes cotton, mordanted with tannin and tartar emetic, violet. Used to a very limited extent in admixtures with Methylene Blue, for the production of pure violet shades; (*e. g.* Gentianine (Gy)). Shows red fluorescence.	
Gentianine (*Gy*) Components— *p*-Phenylenediamine, Dimethyl-*p*-phenylenediamine, Sulphuretted hydrogen and ferric chloride. No. 921	A reddish-brown powder. H_2O: Readily soluble with a bluish-violet colour. Alcohol: Less readily soluble than in water. HCl to aqueous solution: Greener solution. NaOH: More violet solution and then dull violet precipitate. H_2SO_4: yellowish-green solution; blue solution and then bluish-violet solution on dilution. Dyes cotton, mordanted with tannin and tartar emetic, bluish-violet. (See Lauth's Violet.) *Formanek's* statement that Gentianine is a mixture is correct.	
Methylene Blue Components— Dimethyl-*p*-phenylene-diamine, Sodium thiosulphate and dimethylaniline.	A dark blue or reddish-brown bronzy powder. In water: $\lambda =$ **667.8 and 609.3.** H_2O: blue solution. **Red fluorescence,** especially in artificial light. Very characteristic. Alcohol: Less readily soluble than in water. HCl to aqueous solution: Unaltered. NaOH: More violet solution and dull violet precipitate with	

Zinc double chloride— $2C_{16}H_{18}N_3SCl + ZnCl_2 + H_2O$. No. 922 (659)	a large excess. H_2SO_4: Yellowish-green solution; blue solution on dilution. Reducing agents yield leuco-Methylene Blue, M. P. 159–160°, which is reoxidised to Methylene Blue by air. Dyes cotton, mordanted with tannin and tartar emetic, blue. Light: 3–4. Used also for compound shades in conjunction with Methyl-Violet (No. 680), Malachite Green (No. 657), Safranine (No. 841), &c.; also for topping Alizarine Blue, Alizarine Yellow and Indigo; also for dyeing cotton in half-silk and for dyeing jute, coconut-fibre, straw, artificial flowers, &c. Not discharged satisfactorily by any of the usual reagents except sodium hydroxide and glucose. It is used in calico printing as a tannin steam colour, and also in combination with Alizarine Yellow GG (No. 36). Methylene Blue is one of the most extensively used basic colouring matters. Zinc-free for print and pharmaceutical use. Leaves body unchanged in urine (used against typhoid fever). Methylene Blue is of considerable value as a staining reagent in bacteriological and histological investigations. Methylene Blue is estimated by boiling a solution with titanous chloride in an atmosphere of carbon dioxide (Knecht), and, owing to its high tinctorial power, it is used analytically for the detection and estimation of many reducing and oxidising agents (Atack). Methylene Blue has also been recommended for use in place of starch for iodometric titrations (Sinnatt), for the determination of the relative adsorption capacities of samples of fuller's earth (Seidell), and as inside indicator for sugar titrations (Eynon and Lane).
Methylene Azure (B) Trimethyldiaminodiphenazthionium chloride, together with some amino-dimethylamino-diphenazthionium chloride. No. 923	Green glistening crystals. H_2O: Blue solution. Alcohol: Very sparingly soluble with a reddish-brown fluorescence. HCl to aqueous solution: Violet-blue solution. NaOH: Violet precipitate. H_2SO_4: Green solution; blue solution on dilution. HNO_3: Green. Dyes cotton, mordanted with tannin and tartar emetic, a redder shade of blue, faster to washing than Methylene Blue (No. 922).

Methylene Green B paste, B, G, P extra, P for silk, extra yellow DG, extra yellow conc. GG, G extra conc. (JBS) (Gy) (SCI) (StD) (LBH) (NAC) (B) (By) (S) (MLB) (SCI) (MLB) (tM) Zinc double chloride of tetramethyl-diamino-nitro-diphenazthionium chloride. No. 924 (660)	A dark brown or greyish-black powder. In water: λ = 660.0 and 607.2. H_2O: Readily soluble with a greenish-blue colour; highly concentrated solutions show pronounced dichroism. Alcohol: Sparingly soluble with a greenish-blue colour. HCl to aqueous solution: Unaltered. NaOH: Violet solution and violet-black precipitate. H_2SO_4: Dark green solution; greenish-blue solution on dilution. HNO_3: Green-blue. Alcoholic phenylhydrazine yields leuco-Methylene Green, brown needles, M. P. 146–147°, but other reducing agents yield amino-leuco-Methylene Blue. Dyes cotton, mordanted with tannin and tartar emetic, bluish-green. Methylene Green is the fastest green basic colouring matter. Light: 3–2. Used largely for topping black dyed weighted silk, either with logwood, cutch and iron (Monopole Black), or with tin phosphate; also for dyeing silk, in printing half-silk, and in calico printing.
Methylene Blue Toluidine Blue O, (A) (B) (MLB) Zinc double chloride of amino-dimethyl-amino-toluphenazthionium chloride. No. 925	150 extra (B.D.C.). A dark green powder. H_2O: Bluish-violet solution. **Red fluorescence.** λ = 662.0. Alcohol: Blue solution. HCl to aqueous solution: Blue solution. NaOH: Dull violet precipitate. H_2SO_4: Yellowish-green solution; blue solution on dilution. HNO_3: Green. Dyes cotton, mordanted with tannin and tartar emetic, blue. Especially used for printing silk. Light: 4–3.
Thionine Blue, B, R, G, GO, GO old, O, O extra. Zinc double chloride of trimethyl-ethyldiamino-diphenazthionium chloride. No. 926 (661)	A reddish-brown powder. In water: λ = 670.7 and 612.9. H_2O: Blue solution. Alcohol: Less soluble than in water. HCl to aqueous solution: Unaltered. NaOH: Violet solution, violet precipitate with a large excess. H_2SO_4: Yellowish-green solution; blue solution on dilution. HNO_3: Green Dyes cotton, mordanted with tannin and tartar emetic, blue. Light: 4–3. Used also in calico printing, particularly for Aniline Black discharge effects. Thionine Blue GO old (MLB) is particularly suitable as a coloured addition to hydrosulphite discharges and the leuco compound must be re-oxidised with dichromate after ageing.

Not a commercial product.

New Methylene Blue **NSS**, S, NS, N, GB, NSSF, NX, R, 3R, (BDC) (C) (BDC) (S) (MLy) (C) (MLB) (C) Methylene Blue NN (B) Zinc double chloride of diethyl-diamino-ditoluazthionium chloride. No. 927 (663)	A brown crystalline powder with a metallic lustre. In water: λ = 636.4 and 588.0. H_2O: Violet-blue solution cold, pale blue solution hot. Alcohol: Greenish-blue solution. HCl to aqueous solution: Pure blue solution. NaOH: Chocolate-brown precipitate. H_2SO_4: Yellowish-green solution; pure blue solution on dilution. Dyes cotton, mordanted with tannin and tartar emetic, a fuller and redder shade of blue than Methylene Blue (No. 922), faster to acids, but less fast to alkalies than the latter. Used also in calico printing. Discharged by sodium hydroxide and glucose to a more satisfactory white than Methylene Blue (No. 922).
Thiocarmine R paste *R*, (MLy) (C) Sodium salt of sulpho-dibenzyl-diethyldiamino-diphenazthionium sulphonate. No. 928 (662)	An indigo-blue powder or paste. In water: λ = 665.9 and 613.0. H_2O: Pure blue solution. Alcohol: Sparingly soluble. HCl to aqueous solution: Unaltered. NaOH: Unaltered cold, violet solution hot. H_2SO_4: Grass-green solution; bright blue solution on dilution. Dyes wool and silk from an acid bath level blue, similar in shade to Indigo Carmine (No. 1180) and faster to washing, but less fast to light than Patent Blue (No. 712) or Cyanol (No. 715), and moderately fast to milling, acids and alkalies. Light: 4–5.
Leucogallothionine DH (*DH*) Components— An alkylated *p*-diamino-aryl-thiosulphonic acid and a gallic acid derivative. No. 929 (664)	A dark violet to black powder. H_2O: Pale violet-blue solution hot. HCl: Scarcely altered. NaOH: Oxidised to a bright bluish-violet solution. H_2SO_4: Red solution; reddish-violet solution on dilution. Dyes chrome-mordanted wool blue to violet, fast to light and washing. Light: 3–2.
Indochromogen S (S) Sodium salt of diethylamino-dihydroxy-sulpho-naphthophenazthionium sulphate. No. 930 (666)	A blue powder. H_2O: Reddish-violet solution. λ: Not sharp, about 580.0. HCl: Yellowish-brown solution. NaOH: Dull violet solution, which changes to blue on boiling owing to the formation of Indochromine T (No. 931). H_2SO_4: Greenish-yellow solution; brownish-yellow solution on dilution. Dyes chrome-mordanted fabrics blue. A bright greenish-blue, fast to light and readily discharged by chlorate and yellow prussiate is obtained by

	printing on oiled calico in conjunction with a chromium mordant.	
Indochromine T, (S) Brilliant Alizarine Blue G, R, D, 3R, SD, *(BDC)* *(By)* *(By)* Dimethylamino-dihydroxynaphthophenazthionium sulphonate, or benzylethylamino-dihydroxy-naphthophenazthionium sulphonate. No. 931 (667)	*Indochromine T*— A blue powder. In water: λ = 580.8 for Indochromine T. H_2O: Blue solution. HCl: Blue precipitate. NaOH: Unaltered. H_2SO_4: Green solution; violet blue precipitate on dilution. *Brilliant Alizarine Blue G:* λ = 573.0. A greenish-brown bronzy paste. H_2O: Sparingly soluble cold, more readily soluble hot, and crystallises on cooling. NaOH: Violet-blue solution; violet precipitate on addition of hydrochloric acid. H_2SO_4: Green solution, violet precipitate on dilution. Dyes chrome-mordanted wool, cotton and silk bright reddish-blue to greenish-blue, fast to light and washing. Discharged white by chlorate and yellow prussiate on cotton. Brilliant Alizarine Blue SD is suitable for use in calico printing.	
Urania Blue *(WDC)* Components— Dimethyl-*p*-phenylenediamine, Sodium thiosulphate and Di-β-naphthyl-*m*-phenylenediamine disulphonic acid. No. 932 (665)	A bluish-violet powder with a bronzy lustre. H_2O: Blue solution. λ = 611.7 and 575.5. Alcohol: Sparingly soluble. HCl to aqueous solution: Soluble dark blue precipitate. NaOH: Unaltered. H_2SO_4: Brownish-green solution; blue solution on dilution. Dyes wool and silk from an acid bath a purer and greener blue than Naphthazine Blue (No. 855). Used mainly for dyeing silk. Light: 4–3.	

SULPHUR COLOURING MATTERS

No. 933–1012

Sulphur Dyes

The constitution of the Sulphur colouring matters is not known with certainty. Probably they contain the thio-diphenylamine grouping (see under Thiazines), and very probably they contain SH-radicals.

Sulphur dyes are, as a rule, insoluble in water, but are readily brought into solution by means of sodium sulphide and also hydrosulphite. Most of the Sulphur dyes evolve hydrogen sulphide when heated with mineral acids, but this test must not be taken as

absolute. (See *Green:* The Analysis of Dyestuffs.) On heating one grm. of the dye in a test tube with 5 c.c. of hydrochloric acid (10%), lead acetate paper (moistened) will, as a rule, give the characteristic brown-black coloration, when introduced in the upper end of the tube while its contents are boiling. The best test for sulphur dyes is their property of dyeing unmordanted cotton from sodium sulphide solution when heated.

Cross Dye Deep Brown R (BDC) Components: Products of organic refuse (sawdust, bran, &c.), sulphur and sodium sulphide. No. 933 (706)	*Cachou de Laval*— (The first Sulphide dye.) Porous hygroscopic black lumps, rapidly affected by exposure to air. H_2O: Readily soluble cold with a black colour, but rendered insoluble by prolonged boiling. *Katigene Black-Brown N*— Amorphous hygroscopic black lumps. H_2O: Sparingly soluble cold, readily soluble hot (300 grm. per litre of boiling water). HCl: Evolution of hydrogen sulphide and sulphur dioxide. NaOH: Greenish solution. H_2SO_4: Dark yellowish-brown solution. Dyes cotton direct from an alkaline bath greenish-brown, converted by exposure to air or by oxidation with dichromate into brown, very fast to washing, alkalies and acids, moderately fast to light, but destroyed by chlorine or hydrogen peroxide. *Cachou de Laval S* was used formerly in calico printing.	
Cattu Italiano (*LD*) Components— Oils, fats or fatty acids, sulphur and sodium carbonate. *No.* 934 (707)	A black coke-like mass. H_2O: Readily soluble with a dark green colour; the colour gradually changes on keeping to dark brown, and finally a blackish-brown flocculent precipitate separates. Alcohol: Insoluble. HCl to aqueous solution: Precipitate and evolution of hydrogen sulphide. NaOH: Unaltered. H_2SO_4: Insoluble; evolution of hydrogen sulphide. Dyes cotton direct from a salt bath black-brown, converted by oxidation with faintly acid dichromate into reddish-brown, moderately fast to soap, acids and light, but not fast to chlorine. Not manufactured.	
Sulphaniline Brown 4B (*K*) Components— Sulphite-cellulose waste liquors (free	A black powder. H_2O: Readily soluble with a dark brown colour. Alcohol: Insoluble. HCl to aqueous solution: Dark brown precipitate.	

from calcium), sodium sulphide and sulphur. No. 935 (708)	NaOH: Unaltered. H_2SO_4: Brown solution, dark brown precipitate on dilution. Dyes cotton direct from a sodium sulphide and salt bath dark brown, fast to light; the fastness is increased by after-chroming. Not manufactured.	
Sulphur Brown R (*AAP*) Components— Acetyl-*p*-phenylenediamine- and Sulphur or Diacetyldinitrobenzidine, sulphur and sodium sulphide. No. 936 (715)	Blackish lumps. H_2O: Brown solution. Na_2S: Yellowish-brown solution. HCl to aqueous solution: Precipitate and evolution of hydrogen sulphide. NaOH: Yellowish-brown solution, decolorised by addition of zinc dust. H_2SO_4: Brownish-red solution, precipitate on dilution. Dyes cotton direct from a salt bath cutch-brown of good fastness to washing, acids and alkalies, moderately fast to light, but destroyed by chlorine; after-treatment with dichromate is necessary to fix the colour on the fibre. Scarcely manufactured.	
Katigen Brown **Eclipse Brown B** (Gy) Components— *m*-Toluylenediamine, Oxalic acid, sodium sulphide and sulphur or *o*- and *p*-cresols. No. 937	H_2O: Chestnut-brown solution. HCl: Dark brown precipitate. H_2SO_4: Brownish-orange solution. Dyes cotton direct from a sodium sulphide and salt bath orange-brown, converted by oxidation into yellowish-brown, fast to acids, alkalies and washing, and moderately fast to light. The cresol browns are very cheap.	
Cotton Brown (*WDC*) Components— Diphenylamine (treated with 20% fuming sulphuric acid and then with nitric acid), sodium sulphide and sulphur. No. 938 (737)	Dark brown lumps. H_2O: Brown solution. Alcohol: Insoluble. HCl to aqueous solution: Brown precipitate. H_2SO_4: Brown solution. Dyes cotton direct from a sodium sulphide bath brown, fast to milling and moderately fast to light. Not manufactured.	
Thional Brown B **(BDC)** Components— 2:4-Dinitro-4′-hydroxydiphenylamine (from 1-chloro-2:4-dinitrobenzene and *p*-aminophenol) and aqueous sodium hydroxide; sulphur and sodium sulphide. No. 939 (725)	A brownish-black powder. H_2O: Readily soluble. HCl: Brown precipitate. NaOH: Unaltered. H_2SO_4: Brown solution, brown precipitate on dilution. Dyes cotton direct from a boiling sodium sulphide and salt bath intense yellowish-brown, of good general fastness, but only moderately fast to light and rendered yellower and faster by after-chroming. A cheap red-brown.	
Kryogene Brown A, G, **(By)**	*Kryogene Brown G*— A light brown powder.	

Components— 1:8-Dinitronaphthalene and sodium bisulphide; sodium sulphide and sulphur. No. 940 (750)	H_2O: Insoluble. Alcohol: Insoluble. HCl: Insoluble. NaOH: Partially soluble hot, with a yellowish-brown colour. H_2SO_4: Dull light brown solution, brown precipitate on dilution. Dyes cotton direct from a sodium sulphide bath brownish-yellow, fast to washing and moderately fast to light. In fairly general use.
Thional Bronze G, GV (*S*) Components— β-Hydroxynaphthaquinone-aryl-imines (from β-naphthaquinone-4-sulphonic acid and various amines), sodium sulphide and sulphur. No. 941 (747)	A brownish-black powder. H_2O: Yellowish-brown to dark brown solutions in presence of sodium sulphide. Alcohol: Almost insoluble. HCl to sodium sulphide solution: Brown precipitate. NaOH: Unaltered. H_2SO_4: Very sparingly soluble. Dyes cotton direct from a sodium sulphide bath yellowish-brown, dark brown or bronze, very fast to washing, alkalies and acids, and moderately fast to light. Not much used.
Kryogene Brown RB (B) No. 942 (751) Made from mixtures of Cresols.	A brownish-black powder. H_2O: Partially soluble hot, with a brown colour. Alcohol: Insoluble. NaOH: Brown solution. HCl to alkaline solution: Brown precipitate. Na_2S: Soluble. H_2SO_4: Brown solution, brown precipitate on dilution. Dyes cotton direct from a sodium sulphide bath yellowish-brown of good fastness to washing and moderate fastness to light.
Sulfogene Brown D, G (SCI) No. 943 (757) See 942	*Sulfogene Brown G*— A brown powder. H_2O: Brown solution. HCl: Brown precipitate. NaOH: Unaltered. H_2SO_4: Brown solution, brown precipitate on dilution. Dyes cotton direct from a sodium sulphide and salt bath reddish-brown, very fast to light, washing, alkalies and acids. *Sulphogene Brown D*— Dyes cotton blackish-olive-brown.
Thion Brown G, O, R (K) Components— 2:4:5-Triamino-toluene (or benzene-azo-*m*-toluylenediamine), sodium sulphide and sulphur. No. 944	A brownish-black powder. H_2O: Brown solution. Alcohol: Sparingly soluble with a yellowish-brown colour. HCl to aqueous solution: Dark brown precipitate. NaOH: Unaltered. H_2SO_4: Brown solution. Dyes cotton direct from a sodium sulphide bath yellowish-brown. Scarcely made.

Immedial Bronze (*C*) Components— Dinitro-*p*-cresol, sodium sulphide and sulphur. No. 945	A brownish-black powder. H_2O: Brown solution. HCl: brown precipitate. NaOH: Unaltered. H_2SO_4: Brown solution, brown precipitate on dilution. Dyes cotton direct from a boiling sodium sulphide and salt bath bronze-brown.
Thiophor Bronze 5G (CJ) Components— *p*-Phenylenediamine-*p*-Aminoacetanilide and Sulphur; and Sodium sulphide. No. 946 (713)	A blackish powder. H_2O: Insoluble. Alcohol: Insoluble. Na_2S: Cutch-brown solution. HCl to sodium sulphide solution: Light brown precipitate. H_2SO_4: Sparingly soluble with a greyish-olive colour, light brown solution on dilution. Dyes cotton direct from a sodium sulphide bath fast bronze-green. A cheap product for khaki.
Thiophor Yellow-Bronze G (CJ) Components— *p*-Phenylenediamine-*p*-aminoacetanilide, benzidine and sulphur; and sodium sulphide. No. 947 (714)	A dark olive-brown or blackish powder. H_2O: Insoluble. Alcohol: Insoluble. Na_2S: Cutch-brown solution. HCl to sodium sulphide solution: Light brown precipitate. H_2SO_4: Sparingly soluble with a yellowish-brown colour, greyish-brown precipitate on dilution. Dyes cotton direct from a sodium sulphide bath fast yellowish-bronze-green.
Immedial Yellow (C) Thionone Yellow G new, R, 2R (LBH) Thion Yellow G, GG, GN (*K*) Components— *m*-Toluylenediamine benzidine and sulphur; and sodium sulphide or sodium hydroxide. No. 948 (710)	A brownish-yellow powder. H_2O: Insoluble. NaOH: Insoluble. Na_2S: Orange-brown solution. H_2SO_4: Partially soluble, brown precipitate on dilution. Dyes cotton direct from a sodium sulphide bath yellow. In cross-dyeing the shade becomes more orange, but the wool remains unstained. The shade is rendered duller and faster to light by after-treatment with dichromate or copper sulphate. *Immedial Yellow D* was the first yellow sulphide dye of commercial value.
Immedial Orange C (C) Components— *m*-Toluylenediamine and sulphur; and sodium sulphide. No. 949 (711)	A dark brown powder. H_2O: Clear orange-brown solution in presence of sodium sulphide. Alcohol: Insoluble. H_2SO_4: Almost insoluble. Dyes cotton direct from a sodium sulphide bath vivid orange-brown, absolutely fast to washing and acids; the shade is scarcely affected by oxidation with dichromate, but is rendered somewhat brighter by hydrogen peroxide.

	In cross-dyeing the shade becomes slightly redder. *Immedial Orange C* was the first orange sulphide dye of commercial value.	
Thiochem Sulphur Yellow R conc. (*AJ*) Components— Formyl-*m*-toluylene-diamine-aniline and sulphur. No. 950	A yellow powder. H_2O: Insoluble. NaOH: Soluble. Na_2S: Soluble. Dyes cotton direct from a sodium sulphide bath orange-yellow, fast to milling and cross-dyeing, and of moderate fastness to light.	
Eclipse Yellow G, 3G, R extra conc. (**Gy**) Components— Diformyl- (or mono-formyl-) *m*-toluylene-diamine and sulphur; with or without benzidine, and primuline base and sodium sulphide. No. 951	Na_2S: Pure yellow to golden-yellow solutions. H_2SO_4: Yellow milky solution. Dyes cotton direct from a sodium sulphide and salt bath yellow, fast to washing.	
Kryogene Yellow G, GG extra (B) Components— *m*-Toluylenedithio-urea, benzidine and sulphur. No. 952 (712) Many other components are used (see 950, 951)	A light brown powder. H_2O: Insoluble. Alcohol: Insoluble. HCl: Unaltered. NaOH: Unaltered. H_2SO_4: Pale yellow solution, yellowish-brown precipitate on dilution. Dyes cotton direct from a sodium sulphide bath sulphur-yellow, fast to washing.	
Kryogene Yellow R, R extra (B) Components— Amino-α-methyl-benziminazole (from 2:4-dinitro-acetanilide) and sulphur; and sodium sulphide. No. 953 (716)	A yellowish-brown powder. H_2O: Partially soluble hot with a yellow colour. Alcohol: Traces dissolve with a yellow colour. HCl: Insoluble. NaOH: Partially soluble hot. H_2SO_4: Dirty yellow solution, yellowish-brown precipitate on dilution. Dyes cotton direct from a sodium sulphide bath yellow, fast to washing.	
Pyrogene Yellow M (SCI) Pyrogene Olive N (SCI) No. 954 (734) Similar to Eclipse Yellow.	Brown to black powders. H_2O: More or less readily soluble in presence of sodium sulphide. HCl to sodium sulphide solution: Precipitate. Dyes cotton direct from a sodium sulphide bath yellow to olive, fast to washing and converted into bright orange, fast to light and chlorine, by treatment with cold ¾° Tw. hypochlorite for ½ hour.	
Sulphogene Yellow GG (DuP)	A dirty yellow powder. H_2O: Insoluble.	

Immedial Yellow GG (C) Components— Dehydrothio-*p*-toluidine, benzidine, sulphur, and sodium sulphide. No. 955	NaOH: Insoluble. Na_2S: Yellowish-brown solution. H_2SO_4: Yellowish-grey solution, brown precipitate on dilution. Dyes cotton direct from a sodium sulphide bath greenish-yellow, fast to washing. **One of the best Sulphur Yellows.**	
Pyrogene Direct Blue Green shade, red shade, RL, (CAC) (SCI) (SCI) Thional Dark Blue RL (S) Components— 2:4-Dinitro-4′-hydroxydiphenylamine, sodium tetrasulphide and alcohol. No. 956 (726)	*Pyrogene Blue*— A dark blue powder with a coppery lustre. H_2O: Insoluble. λ: not sharp in N_2S. Na_2S: Violet-blue solution, precipitated by carbon dioxide. β-Naphthol: Reddish-violet solution. Dyes cotton direct from a sodium sulphide bath violet-blue to bluish-black, rendered brighter and faster by oxidation (in substance or on the fibre), fast to light, washing and chlorine. *Pyrogene Grey*— A dark powder with a coppery lustre. H_2O: Insoluble. Na_2S: Greenish-blue solution. β-Naphthol: Insoluble. Dyes cotton direct from a sodium sulphide and salt bath grey, fast to washing and unaffected by oxidation.	
Immedial Pure Blue (C) Components— 4-Dimethylamino-4-hydroxydiphenylamine (from *p*-aminodimethylaniline and phenol), sodium sulphide and sulphur. No. 957 (728)	A coppery glistening powder. In water: λ = 626.0 and 582.0. H_2O: Partially soluble with a blue colour. Na_2S: Blue solution. NaOH: Blue solution. H_2SO_4: Pure blue solution. Dyes cotton direct from a sodium sulphide bath bright pure blue (the purest shades are obtained at 30–35°), fast to milling, acids and alkalies, moderately fast to light, but of low fastness to chlorine; the fastness to washing and light is increased by after-treatment with dichromate or copper sulphate. Used also in calico printing. Discharged white by chlorate. The first Sulphide dye of a pure blue shade.	
Eclipse Blue B, R (Gy) See 957. No. 958	A dark blue powder with a coppery lustre. Na_2S: Blue solution. NaOH: Blue solution hot. H_2SO_4: Blackish-blue solution. HNO_3 Dyes cotton direct from a sodium sulphide bath pure blue of good general fastness.	
Thionone Indigo B, R (LBH) **Katigene Indigo R**	A dark blue powder. H_2O: Insoluble. NaOH: Insoluble. Na_2S: Yellowish-brown solution.	

extra, (By) **Immedial Indone R, R conc.** (C) Components— Indophenol (from toluidine and *p*-nitrosophenol), sodium sulphide and sulphur. No. 959 (733)	H_2SO_4: Blue solution; violet solution and then dark blue precipitate on dilution. Dyes cotton direct from a sodium sulphide bath, preferably at 40–50°, followed by exposure to air, indigo-blue, moderately fast to washing and acids, and fast to light, particularly in pale shades, as it fades in the same tone. *Immedial Indone* possesses a remarkable affinity for cotton. An important blue.	
Kryogene Pure Blue R (*B*) Components— Methylene Violet (No. 842), sodium sulphide and sulphur. No. 960 (729)	A dark brown powder. H_2O: Partially soluble hot, with a blue colour. Alcohol: Partially soluble hot, with a violet colour and a brown fluorescence. HCl: Bluish-violet solution. NaOH: Insoluble. H_2SO_4: Vivid blue solution, blue precipitate on dilution. Dyes cotton direct from a sodium sulphide bath pure blue, fast to washing.	
Pyrogene Indigo AF, BL, 5G, GL, R, RR, (SCI) (SCI) Components— 4-Phenylamino-4′-hydroxy-diphenylamine (from diphenylamine and *p*-nitrosophenol), sodium sulphide and sulphur in absolute alcohol. No. 961 (735)	A dark blue powder. H_2O: Insoluble. Na_2S: Blue solution cold, yellowish-green solution hot. NaOH: Blue solution. H_2SO_4: Steel-blue solution. Dyes cotton direct from a sodium sulphide bath at 55–60° yellow, oxidised by air to vivid indigo-blue. One of the most important sulphur Blues (see Hydron Blue).	
Thion Blue B (*K*) Components— 4-Nitro-2-amino-4-hydroxydiphenylamine and carbon bisulphide; sodium sulphide and sulphur. No. 962 (736)	A bluish-grey powder. H_2O: Greenish-blue solution. Alcohol: Insoluble. HCl to aqueous solution: Blue precipitate. NaOH: Bluish-red precipitate. Na_2S: Blue solution. H_2SO_4: Greenish-blue solution, bluish-grey precipitate on dilution. Dyes cotton direct from a soda alkaline Glauber's salt bath containing sodium sulphide bluish-grey, oxidised by air to very pure blue. Brighter and redder shades of blue are obtained by treating the dyed material with hydrogen peroxide or stannic chloride. Not made.	
Thiophor Indigo CJ (*CJ*) Components— Indophenol (from *p*-aminodimethylaniline and α-naphthol), sodium sulphide and sulphur.	A dark blue powder. H_2O: Insoluble. Alcohol: Blue solution. Benzene: soluble hot, and on cooling the solution small, coppery, glistening, truncated prisms separate. Na_2S: Greenish-yellow solution. HCl to sodium sulphide solution: Light brownish	

No. 963 (731)	precipitate due to the fact that the dye retains the indophenolic property of being hydrolysed by acids. H_2SO_4: Brownish-yellow solution with decomposition (distinction from all other Sulphide dyes), light brown precipitate on dilution. Dyes cotton direct from a sodium sulphide bath blue, fast to washing and alkalies, moderately fast to light, but destroyed by acids. A fairly important blue.	
Kryogene Blue B, G, R (*B*) Components— 1:8-Dinitronaphthalene (or 1:5-dinitronaphthalene), sodium sulphide and sulphur. No. 964 (743)	H_2O: Insoluble. Alcohol: Insoluble. NaOH: Bluish-green, green, blue or olive solutions. HCl to alkaline solution: Blue precipitate. H_2SO_4: Dull bluish-green to brown solution. Dyes cotton direct from a cold sodium sulphide bath blue; development by steaming or storing is recommended. *Kryogene Blue B*, however, is dyed from a warm sodium sulphide bath. Hardly manufactured.	
Melanogen Blue B, BG, D (*MLB*) Components— 1:5-Dinitronaphthalene, sodium sulphide and sulphur (and zinc chloride). No. 965 (745)	A dark powder. In water: $\lambda = 578.2$ and 534.6. H_2O: Dark blue solution. HCl: Precipitate. Dyes cotton direct (without sodium sulphide) greenish-blue to bluish-violet (unaffected by air oxidation during dyeing), fast to washing, converted by after-treatment with copper sulphate into deep blue-black of increased fastness. Melanogen Blue is distinguished from most other Sulphide dyes by possessing mordant dyeing properties. Used mainly for bottoming vat blues; also in calico printing. Discharged white in a similar manner to Indigo.	
Kryogene Direct Blue GO, (*B*) No. 966 (752)	A violet-black powder. H_2O: Somewhat soluble, hot. Alcohol: Insoluble. HCl: Insoluble. NaOH: Partially soluble hot, with a greyish-black colour, converted into blue by exposure to air. H_2SO_4: Dull blue solution, dark blue precipitate on dilution. Dyes cotton direct from a sodium sulphide bath greenish-blue, fast to washing and of moderate fastness to light.	
Kryogene Direct Blue B, (*B*) No. 967 (753)	A violet-black powder. H_2O: Insoluble. Alcohol: Partially soluble hot, with a reddish-violet colour. HCl: Insoluble.	

	NaOH: Partially soluble hot, with a greenish-black colour. H_2SO_4: Bluish black solution, bluish-black precipitate on dilution. Dyes cotton direct from a sodium sulphide bath reddish-blue, fast to washing and of moderate fastness to light.	
Kryogene Direct Blue 3B extra, (*B*) No. 968 (754)	A violet-black powder. H_2O: Insoluble. Alcohol: Traces dissolve hot, with a violet colour and a brown fluorescence. HCl: Insoluble. NaOH: Insoluble cold; traces dissolve hot, with a violet colour. H_2SO_4: Blue solution, violet precipitate on dilution. Dyes cotton direct from a sodium sulphide bath reddish-blue, fast to washing and of moderate fastness to light.	
Hydron Blue R pdr., 20% paste, (**C**) Components— Carbazole Indophenol (No. 822), sodium sulphide, sulphur and alcohol. No. 969 (748)	A dark blue-black paste or blue-black powder with a coppery lustre. Na_2S: very sparingly soluble with a yellowish-green colour. H_2SO_4: Dark blue solution, dark blue precipitate on dilution. Dyes cotton from an orange alkaline hydrosulphite vat at 60–70° blue (redder than No. 971) of excellent fastness to chlorine, light, washing, acids and rubbing. The brightness is improved by after-treatment with perborate. Used particularly to replace Indigo and Indanthrene Dark Blue BO for dyeing cotton yarn, because full shades, **fast to chlorine,** are obtained with a single dip. Not a Sulphur dye, since it is insoluble in Na_2S.	
Indocarbon S, SF (**C**) Components: Carbazole Indophenol (No. 822) sodium sulphide, sulphur and copper sulphate. No. 970 (748)	A black powder. H_2O: Insoluble. NaOH: Insoluble. Na_2S: Orange-brown solution. H_2SO_4: sparingly soluble with a dark blue colour, reddened on dilution. Dyes cotton from a sodium sulphide bath, or from an alkaline hydrosulphite bath, bluish-black of excellent fastness to chlorine. *Indocarbon S, SF* possess the advantage over other black Sulphide dyes that there is no risk of tendering the cotton during subsequent stoving.	
Hydron Blue G pdr., 20% paste, 40% paste **C** Components—	A dark blue-black paste or powder. Na_2S: Very sparingly soluble with a yellowish-brown colour. H_2SO_4: Dark greenish-blue solution, greenish-blue precipitate on dilution.	

N-Ethylcarbazole Indophenol (No. 823), sodium sulphide, sulphur and alcohol. No. 971 (748)	Dyes cotton from a yellow alkaline hydrosulphite vat at 60–70° blue (greener than No. 969) of excellent fastness to chlorine, light, washing, acids and rubbing. The brightness is improved by after-treatment with perborate. Used particularly to replace Indigo and Indanthrene Blue for dyeing cotton yarn, because full shades, **fast to chlorine,** are obtained with a single dip. See Note on 970.	
Hydron Dark Blue B 40% paste, G 40% paste, (**C**) No. 972 Mixtures of 970, 971 and 969.	A dark bluish-black paste with a coppery lustre. Na_2S: Sparingly soluble with a brownish-yellow colour. H_2SO_4: Dark blue solution, dark blue precipitate on dilution. Dyes cotton from a brownish-yellow alkaline **hydrosulphite vat,** or preferably from a sodium sulphide and hydrosulphite vat, dark blue, fast to light, washing and chlorine. The brightness is improved by after-treatment with perborate. Used also for saddening Hydron Blues (Nos. 969, 971). Not a Sulphur dye.	
Vidal Black (*StD*) Components— *p*-Aminophenol (or *p*-phenylenediamine, &c.), sodium sulphide and sulphur. No. 973 (717)	Black lumps with a bronze reflex. H_2O: Bottle-green solution. HCl: Brown precipitate. NaOH: Unaltered; the solution is decolorised by adding zinc dust. Na_2CO_3: Bluer solution. H_2SO_4: Yellowish-green solution. Dyes cotton direct greyish-blue to bluish-black, converted by oxidation with dichromate into black, very fast to washing, light, alkalies and acids. The first black Sulphide dye. Not manufactured.	
Clayton Fast Grey D, S (*CAC*) Possibly thiosulphonic acids or sulphides of Aniline Black (No. 870). No. 974	A black powder. H_2O: Insoluble. Na_2S: Coal-black solution. HCl to sodium sulphide solution: Black precipitate. NaOH: Unaltered. Na_2SO_3: Violet-black solution. H_2SO_4: Blue-black solution, black precipitate on dilution. Dyes cotton direct from a sodium sulphide bath, or caustic soda and glucose bath grey or black, rendered very fast to washing, light, alkalies and acids by after-treatment with dichromate and copper sulphate. Can be used also in calico printing with a caustic soda and glucose prepare for fast black. Not manufactured.	

Eclipse Black B, (Gy) Pyrol Black, various brands, (*L*) Components— *p*-Aminophenol and phenol, and *p*-aminophenol sodium sulphide and sulphur. No. 975	H_2O: Sparingly soluble with a blackish-blue colour. NaOH: Blue solution. HCl: Black precipitate. H_2SO_4: Blackish-blue solution, black precipitate on dilution. Dyes cotton direct from a sodium sulphide and salt bath black, fast to light and washing.
St. Denis Black B (*StD*) Components— Phenol- (or its homologues), sulphur chloride, *p*-Phenylenediamine and nitrobenzene; sodium sulphide. No. 976 (718)	A black powder. H_2O: Blackish-blue-green solution. HCl: Precipitate. NaOH: Bluer solu-solution. H_2SO_4: Blackish-green solution, precipitate on dilution. Dyes cotton direct from a sodium sulphide and salt bath, or Glauber's salt bath, black (20% of dye), rendered more intense by after-chroming.
Thionol Black (*Lev*) Components— *p*- (or *o*- or *m*-) Nitrobenzene-azo-*o*-nitrophenol (with or without benzene-azo-*o*-nitro-phenol), sodium sulphide and sulphur. No. 977 (719)	Not manufactured. A black powder. H_2O: Insoluble. Alcohol: Insoluble. Na_2S: Blue-black solution. NaOH: blue solution. Dyes cotton direct from a sodium sulphide bath deep black, fast to washing, light and acids. Not manufactured.
Sulphur Black T (A) Cross Dye Black FG, FNG, BX, (BDC) (H) Thionol Printing Black No. 2 (BDC) Pyrogene Deep Black (CAC) (SCI) Katigen Deep Black GGN (GCC) Kryogene Black TGS (B) Thiogene Black, liquid, (MLB) (MLB) Components— *m*-Dinitrophenol	The reactions of the different commercia products vary with the conditions employed in their preparation. **Sulphur Black T extra** (A)— A black powder. H_2O: Insoluble. Alcohol: Insoluble. Na_2S: Blackish-green-blue solution. NaOH to sodium sulphide solution: Rather bluer solution. HCl to sodium sulphide solution: Greenish-black precipitate. H_2SO_4: Sparingly soluble cold, dull greenish-blue solution hot, converted into black-blue by further heating. 25% Fuming Sulphuric Acid: Black-blue solution, greenish-precipitate on dilution. Dyes cotton direct from a sodium sulphide bath intense black, fully developed by air-oxidation; the shade is unaffected by after-chroming. The only important Sulphur Black. Increasing the amounts of sulphur changes the shade from reddish to greenish.

(or 1-Chloro-2:4-dinitro-benzene), sodium sulphide and sulphur. No. 978 (720)		
Immedial Black N (C) Auronal Black N (*tM*) Components— *m*-Dinitrophenol sodium salt, sodium sulphide and sulphur. No. 979 (722)	*Auronal Black N*— A black powder. H_2O: Insoluble. Alcohol: Insoluble. HCl: Insoluble. NaOH: Insoluble. H_2SO_4: Slightly soluble with a violet colour; violet precipitate on dilution. Dyes cotton direct from a sodium sulphide bath black. Very little used to-day.	
Auronal Printing Black paste 4BN extra, 6G extra N, N5G extra, (*tM*) Components— Auronal Black N (No. 979) and sodium sulphide. No. 980	Used in calico printing in admixture with dilute alkalies and the usual thickening agents. The fabric is steamed after printing to decompose the dye compound.	
Autogene Black EEB (*StD*) Components— *m*-Dinitrophenol sodium salt, sodium sulphide and sulphur. No. 981 (723)	A black powder. H_2O: Insoluble. Na_2S: Dark blue solution. H_2SO_4: Almost insoluble. Dyes cotton direct from a sodium sulphide and salt bath black. Like Sulphur Black T.	
Thional Black (*S*) Components— *m*-Dinitrophenol, sodium thiosulphate and sodium hydroxide. No. 982	A black powder. H_2O: Insoluble. Na_2S: Greenish-black solution. NaOH: Greenish-black solution. H_2SO_4: Insoluble, even at 100°. Dyes cotton direct from a sodium sulphide bath deep black (8% of dye), fast to light and washing. Like Sulphur black T.	
Cross Dye Black RX (*H*) Components: Picramic acid, sodium sulphide and sulphur. No. 983	A dark powder. H_2O: Greenish-black solution. Na_2S: Greenish-black solution. NaOH: Blue-black solution, blue-black precipitate with excess. HCl: Greenish-black precipitate. H_2SO_4: Sparingly soluble with a blue-black colour, greenish-black flocculent precipitate on dilution. Dyes cotton direct from a sodium sulphide and salt bath violet-black.	
Thionol Purple B conc. (*BDC*) Components— Picric acid, sodium sulphide and sulphur.	A black powder. H_2O: insoluble or partially soluble. NaOH: Sparingly soluble with a dark blue colour. Na_2S: Dark green solution. H_2SO_4: Brownish-black solu-	

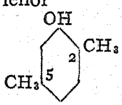
No. 984	tion, brownish-black precipitate on dilution. Dyes cotton direct from a sodium sulphide bath reddish-black, fast to light and cross-dyeing, and of good fastness to milling.	
Sulphur Black (*WDC*) Components— *m*-Dinitrophenol, *p*-aminophenol sulphonic acid, sodium sulphide and sulphur. No. 985 (721)	Black porous lumps. H_2O: Bright greenish-blue solution. NaOH: Dark blue solution. H_2SO_4: Sparingly soluble cold with a dull green colour, violet solution hot. Dyes cotton direct from a sodium sulphide bath deep black. The shade is free from the bluish-green or red overhand appearance of Vidal Black (No. 973) and Immedial Black N (No. 979) respectively. Not made.	
Sulphur Black TB, RB extra, (*HP*) Components— *m*-Dinitrophenol (together with other intermediate products), sodium sulphide and sulphur. No. 986	A black powder. H_2O: Insoluble. Alcohol: Insoluble. HCl: Insoluble. NaOH: Blue-black solution. H_2SO_4: violet-black solution; violet solution on dilution. Dyes cotton direct from a sodium sulphide bath black, fast to rubbing, light, acids, alkalies, milling and water. Can be used, in particular, for dyeing loose cotton full reddish-black. Not made.	
Vidal Victory Black B pdr., B extra, Npdr., N extra, R pdr., R extra (*HP*) Components— *m*-Dinitrophenol (and other intermediate products), sodium sulphide and sulphur. No. 987	*Vidal Victory Black pdrs.*— A black powder. H_2O: insoluble. Not manufactured	
Immedial Black FF extra, G extra, NB, V extra, (*C*) Components— 2:4-Dinitro-4-hydroxydiphenylamine (from 1-Chloro-2:4-dinitrobenzene and *p*-aminophenol), sodium sulphide and sulphur. No. 988 (724)	A greyish-black powder. H_2O: Black solution. Alcohol: Insoluble. HCl to aqueous solution: Blackish-brown precipitate. NaOH: Greenish-black precipitate. H_2SO_4: Sparingly soluble with a dark violet colour, blackish-brown precipitate on dilution. Dyes cotton direct from a sodium sulphide or salt bath deep bluish-black, very fast to milling, light and acids, rendered faster and deeper by after-chroming. The direct dyed shade (without after-chroming) is oxidised by hydrogen peroxide, or by air and steam, to bluish-violet (Immedial Blue), fast to light and washing.	

	Immedial Black was the first Sulphide dye to produce deep black direct without after-treatment. Not much used.	
Ortho Black (*CR*) Components— *o*- (or *p*-) Aminophenol and 1-Chloro-2:4-dinitrobenzene (or picryl chloride), sodium sulphide and sulphur. No. 989	Black lumps. H_2O: Greenish-blue solution. Dyes cotton direct from a sodium sulphide bath greenish-back to deep black, rendered faster to light, washing, acids and alkalis by after-treatment with dichromate or copper salts.	No longer manufactured.
Auronal Black B, 2B (*tM*) Components— 2:4-Dinitro-4′-aminodiphenylamine (from 1-Chloro-2:4′-dinitrobenzene and *p*-Phenylenediamine), sodium sulphide, sulphur and glycerol. No. 990 (727)	Black or dark grey powders. H_2O: Violet-red to blackish-blue solution. Na_2S: Blue solution. NaOH: Blue solution. H_2SO_4: Bluish-green solution. Dyes cotton direct from a sodium sulphide bath bluish-black, fast to washing, light, acids and alkalies. The shade is dependent on the temperature at which the dyestuff was formed. The shade is rendered bluer and faster by after-chroming. Not manufactured.	
Pyrogene Black, B,G, (*SCI*) (*SCI*) Components— Nitroaminohydroxydiphenylamine (or Indophenols which contain at least one OH group), sodium sulphide and sulphur. No. 991 (730)	A dark amorphous powder. H_2O: Blue, green or blackish solution. Alcohol: Very sparingly soluble. H_2SO_4: scarcely soluble. Dyes cotton direct from a sodium sulphide bath bluish-green to black (according to the Indophenol used), rendered bluer by oxidation. Very little used.	
Kryogene Black B, BG, C, D, GN (*B*) Components— 1:3-Dichloro-4:6-dinitrobenzene and *p*-aminophenol (or its sulphonic or carboxylic acid); sodium sulphide and sulphur. No. 992	H_2O: Blue to green solutions. HCl: Brown precipitate. NaOH: Blue solution. H_2SO_4: Sparingly soluble with a yellowish-green colour. Dyes cotton direct from a sodium sulphide bath black, fast to light, washing and acids.	
Autogene Black (*StD*) Components— Phenol (or its homologues or amines), and sulphur chloride; *p*-amino- (or di-	A black mass. H_2O: Greenish-black solution. HCl: Brown precipitate. NaOH: Bluer solution. H_2SO_4: Scarcely soluble. Dyes cotton direct from a Glauber's salt bluish-black. Not manufactured.	

amino-) *p*-hydroxydiphenylamine; sodium sulphide. No. 993 (732)		
Cotton Black (*WDC*) Components— Dinitrodiphenylamine sulphonic acid (from 1-Chloro-2:4-dinitrobenzene and metanilic acid or sulphanilic acid), sodium sulphide and sulphur. No. 994 (738)	Black porous lumps. H_2O: Greenish-black solution. Alcohol: Insoluble. HCl to aqueous solution: Brown precipitate. H_2SO_4: Sparingly soluble with a brown colour. Dyes cotton direct from a sodium sulphide bath fast black. The shade and fastness of the dyeings are unaffected by after-treatment with oxidising agents. Not manufactured.	
Sulphanil Black G (*K*) Components— Chloro-2:4-dinitrobenzene and aminosalicylic acid, sodium sulphide and sulphur. No. 995	A black powder. H_2O: Green solution. HCl: Greyish-black precipitate. NaOH: Unaltered. H_2SO_4: sparingly soluble with a dull greenish-blue colour. Dyes cotton direct from a sodium sulphide bath black of good fastness.	
Fast Black B (*B*) Components— 1:8-Dinitronaphthalene (or a mixture of 1:8- and 1:5-dinitronaphthalene) and sodium sulphide. No. 996 (740)	Not manufaccured. A blackish-blue paste. H_2O: Insoluble. Alcohol: Insoluble. NaOH: Insoluble cold, violet solution on prolonged boiling. HCl to alkaline solution: Greenish-black precipitate and evolution of hydrogen sulphide. H_2SO_4: Sparingly soluble with a dull green colour. Dyes cotton direct from a sodium sulphide bath fast blue-black, converted by oxidation with dichromate, permanganate or hypochlorite into brown, very fast to washing, alkalies, acids and stoving.	No longer manufactured.
Fast Black BS (*B*) Components— Fast Black B (No. 996) and sodium hydroxide (or sodium sulphide). No. 997 (741)	A blue-black paste. H_2O: Bluish-violet solution. Alcohol: Bluish-violet solution. HCl to aqueous solution: Black precipitate. NaOH: No precipitate. H_2SO_4: (dry powder) sparingly soluble with a dull green colour. Dyes cotton and silk direct from a cold concentrated soduim sulphide bath (1:5:8) fast deep black. Not manufactured.	
Sulpho Black B, 2B 4B, 6B, (*H*) No. 998 (744)	Black lumps. H_2O: Olive-green to dark blue solutions. Alcohol: Sparingly soluble. HCl to aqueous solution: Yellowish-brown precipitates. H_2SO_4: Olive-green, blue-black or blue solutions; violet precipitates on dilution. Dyes cotton direct from an alkaline bath dark blue to black; fast to light	

	and washing, and rendered darker by after-chroming. Not manufactured.	
Anthraquinone Black (*B*) Components— 1:5-Dinitroanthraquinone (or crude Dinitroanthraquinone), sodium sulphide and sulphur. No. 999 (749)	A black powder. H_2O: Readily soluble with a bluish-green colour. Alcohol: Sparingly soluble with a green colour. HCl to aqueous solution: Precipitate. NaOH: Readily soluble. H_2SO_4: Greyish-black solution, precipitate on dilution. Dyes cotton direct from an alkaline or sodium sulphide bath deep black. Not much used.	
Kryogene Black BNX (*B*) No. 1000 (755)	A greyish-black powder. H_2O: Greyish-black solution, hot. Alcohol: Traces dissolve with a greenish-yellow colour. NaOH: Bluish-black solution. HCl to alkaline solution: Brown precipitate. H_2SO_4: Greyish-black solution, blackish-grey precipitate on dilution. Dyes cotton direct from a sodium sulphide bath and after-treated with metallic salts black, fast to washing and light.	
Kryogene Black TGO (*B*) No. 1001 (756)	A greyish-black powder. H_2O: Insoluble. Alcohol: Insoluble. NaOH: Bluish-black solution, hot. HCl to alkaline solution: Greyish-black precipitate. H_2SO_4: Dirty violet-black solution, greyish-black precipitate on dilution. Dyes cotton direct from a sodium sulphide bath black, fast to washing, light and acids.	
Thional Dark Green GN, (S) Pyrogene Dark Green B, 3B, (*SCI*) Components— *p*-Nitrophenol (or *p*-aminophenol, or derivatives), sodium sulphide, sulphur and copper bronze (or a copper salt). No. 1002 (709)	A black coke-like mass; the presence of copper can be detected readily in the ash. H_2O: Readily soluble with a green colour; an insoluble green precipitate separates on exposure to air. HCl: Black precipitate and evolution of hydrogen sulphide. *Pyrogene Green*— Dyes cotton direct from a bath containing sodium sulphide and 10% of salt green, fast to light, washing and alkalies, but not fast to acids. *Verde Italiano*— Dyes cotton direct from a salt bath dull green, converted into blue-black by oxidation with dichromate or hydrogen peroxide. Little used.	
Sulphur Olive Green (*T*) Components—	A dark green powder. H_2O: Partially soluble. Na_2S: Soluble.	

Benzene-azo-phenol, sodium sulphide, sulphur and a copper salt. No. 1003	Dyes cotton direct from a sodium sulphide bath dark green, fast to milling and cross-dyeing, and of good fastness to light. Scarcely used.
Eclipse Green G conc. (Gy) Immedial green (C) **Components**— *p*-Aminodimethyl-aniline, phenol and sodium sulphite; sodium sulphide, sulphur and copper sulphate (or copper powder). No. 1004	A dark powder; the presence of copper can be detected readily in the ash. H_2O: Dark violet solution. HCl: Light brown precipitate. H_2SO_4: Blackish-brown solution; violet-grey solution on keeping. Dyes cotton direct from a sodium sulphide and salt bath comparatively pure yellowish-green, fast to washing and of moderate fastness to light. The first Sulphur Green.
Thion Green B (*K*) Components— *p*-Hydroxyphenyl-thiourea (from *p*-aminophenol and thiocyanic acid), sodium sulphide and sulphur. No. 1005	H_2O: Bluish-green solution. Na_2S: Bluish-green solution. NaOH: Unaltered. HCl: Brownish-precipitate. H_2SO_4: Insoluble. Dyes cotton direct from a sodium sulphide bath bluish-green, rendered bluer by after-treatment with dichromate.
Thional Green B, BB, GG (S) Pyrogene Green G, 3G (SCI) Katigen Green various brands, (By) Immedial Green BB extra, GG extra, GG double for printing (C) Thiogene Green various brands (MLB) Components— 1-Arylamino-4′-hydroxy-phenyl-aminonaphthalene monosulphonic acid, sodium sulphide and sulphur (and copper	Greenish-black powders. H_2O: Bluish-green to yellowish-green solutions in presence of sodium sulphide. Alcohol: Sparingly soluble. HCl to sodium sulphide solution: Greenish-black precipitate. NaOH: Blue solution. H_2SO_4: Steel-blue solution, blue precipitate on dilution. Dyes cotton direct from a sodium sulphide bath bluish-green to pure yellowish-green, fast to acids, alkalies, and washing, and of moderate fastness to light. The best Sulphur Green!

or a copper salt). No. 1006 (746)		
Thion Violet various brands (*K*) Components— Chloro-2:4-dinitrobenzene, *p*-aminophenol and *p*-nitrosodimethylaniline hydrochloride (or Benzene-azo-*α*-naphthylamine and *p*-aminophenol); sodium sulphide and sulphur. No. 1007	Dyes cotton direct from a sodium sulphide bath various shades of brown-violet, fast to washing, but of only moderate fastness to light.	
Thion Violet B (K) Thiogene Violet B, BD extra conc., V (*MLB*) Components— Phenosafraninone and sulphur or Phenosafran one and sulphur; sodium sulphide and sulphur. No. 1008	*Thiogene Violet V* (*MLB*)— A violet powder. H_2O: Bluish-red solution. HCl: Reddish-brown precipitate. NaOH: Bluer solution. H_2SO_4: Dull reddish-brown solution, reddish-brown precipitate on dilution. Dyes cotton direct from a sodium sulphide bath violet-brown. Thion Violet B (K)—	
Thionol Purple 2B (*Lev*) Components— *p*-Nitrosophenol, *m*-toluylenediamine and aldehyde-bisulphite (or aminohydroxy-phenazines); sodium sulphide, sulphur and copper sulphate (or nickel or cobalt sulphate). No. 1009	Dyes cotton direct from a sodium sulphide bath reddish-purple of moderate fastness. Not manufactured.	
Thiogene Purple O, OD extra conc., (*MLB*) Components— *p*-Nitrosophenol and ethyl-*m*-toluylenediamine; sodium sulphide and sulphur, or *p*-Nitrosophenol *p*-Xylenol  No. 1010.	Thion Violet 3R (K)— Dyes cotton direct from a sodium sulphide bath clear Bordeaux-red, converted into violet by after-treatment with copper salts.	

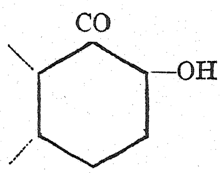
Thiogene Dark Red G, R (*MLB*) Components— Chloro-2:4-dinitrobenzene and *o*-Amino-phenol; sodium sulphide, sulphur and copper sulphate. No. 1011	A brown powder. H_2O: Insoluble. NaOH: Brown solution. H_2SO_4: G, dull violet solution, R, dull brown solution; brown precipitates on dilution. Dyes cotton direct from a sodium sulphide bath reddish- to yellowish-brown of good fastness to washing.	
Immedial Bordeaux G (C) Immedial Maroon B (C) Components— Aminohydroxy-phenazine derivative (3-amino-7-hydroxy-phenazine, or the homologue from *m*-toluylenediamine and *p*-aminophenol), sodium sulphide and sulphur. No. 1012 (739)	According to the materials used and the conditions of the melt, the products dissolve in water, alcohol, sodium hydroxide and sulphuric acid with a brown, violet or red colour. *Thionone Brilliant Claret* 2R— A violet-brown powder. H_2O: Claret solution. HCl: Claret precipitate. NaOH: Brown solution and precipitate. H_2SO_4: Violet solution, claret precipitate on dilution. Dyes cotton direct from a sodium sulphide bath brownish-red, violet-red, or Bordeaux red, very fast to washing and acids, but of only moderate fastness to light. The first reddish Sulphide dye. Rather brown in shade.	

HYDROXY-KETONE DYESTUFFS

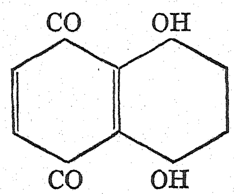
No. 1013–1026

Hydroxy-ketone Dyestuffs

These dyestuffs were formerly very important, but are no longer much in use. They are all Mordant-dyes having the characteristic constitution:



The most important dye of this class was Naphthazarine and its derivatives:



but it has been replaced by Eriochrome Black T, Diamond Black F and other better Wool Blacks. Galloflavine W (No. 1017) is among the Hydroxy-ketone dyes which are used to a considerable extent in calico printing.

Alizarine Yellow C paste (*B*) Trihydroxyacetophenone or gallacetophenone. No. 1013 (769)	A yellowish-white 20% paste; the dried paste crystallises in yellowish or white leaflets, M. P. 168°. H_2O: Sparingly soluble cold, readily soluble hot. Alcohol: Readily soluble. HCl to aqueous solution: Unaltered. NaOH: Brown solution, darkened by air-oxidation. H_2SO_4: Light yellow solution, yellowish precipitate on dilution. Dyes cotton, mordanted with aluminium yellow, or mordanted with chromium brown, or mordanted with iron, black of moderate fastness, but Alizarine Yellow C is not very well adapted for dyeing. Light: 2–3. Used mainly in calico printing on an aluminium mordant for greenish-yellow, fast to light and washing.	
Alizarine Yellow A (*B*) Trihydroxybenzophenone. No. 1014 (770)	A greyish-yellow paste; the dried paste crystallises in light yellow needles ($+H_2O$), M. P. 137–138°. H_2O: Soluble on boiling. HCl: Unaltered. NaOH: Deep yellow solution, rapidly converted into a green product by air-oxidation. H_2SO_4: Yellow solution, yellowish-white precipitate on dilution. HNO_3: Nitration, decomposition. Dyes cotton, mordanted with aluminium and lime, golden-yellow, fast to light and washing. Light: 2–3. Used mainly in calico printing.	
Resoflavine W paste (B) Trihydroxydiphenyldimethylolid. *No.* 1015 (771)	A yellow or greenish-yellow paste. H_2O: Almost insoluble. Alcohol: Yellow solution. Na_2CO_3: Yellow solution and then green solution on standing. NaOH: Yellowish-red solution. H_2SO_4: Yellow solution, yellow precipitate on dilution. Dyes chrome-mordanted wool, or wool from an acid bath and afterchromed with chromium fluoride (but not dichromate), olive-yellow, fast to light, milling, washing, alkalis and acids. Owing to the low solubility the shades are liable to be uneven. An aluminium mordant also can be used. Light: 2–1. Used for dyeing chrome-mordanted wool fast yellow. Scarcely used.	

Alizarine Yellow paste (*MLB*) Ellagic acid or tetrahydroxydiphenyldimethylolid. No. 1016 (931)	*Ellagic Acid*— A yellowish crystalline powder, which sublimes partially on heating without melting. H_2O: Sparingly soluble on boiling. Alcohol: Scarcely soluble; insoluble in ether. Ferric chloride: green coloration and then blue-black coloration. *Alizarine Yellow paste* (*MLB*)— A brownish-white paste. H_2O: Insoluble. Alcohol: Very sparingly soluble. NaOH: Brownish-yellow solution. H_2SO_4: Reddish-brown solution, precipitate of the colour-acid on dilution. Dyes chrome-mordanted wool weak and dull sulphur-yellow of excellent fastness. Light: 1–2. Used to a limited extent for dyeing wool.
Galloflavine W paste (B) Components— Gallic acid oxidised. No. 1017 (772)	A greenish-yellow paste; when the potassium salt is dissolved in water at 90° in absence of air, and then acidfied hydrochloric acid, Galloflavine separates in small greenish-yellow leaflets. H_2O: Insoluble. Alcohol: Sparingly soluble on boiling, with a pale yellow colour and a faint green fluorescence. HCl to the diluted paste: Rather brighter colour. NaOH: Yellowish-brown solution. H_2SO_4: Reddish-yellow solution, greyish-white precipitate on dilution. Dyes chrome-mordanted wool level olive-yellow, fast to light, milling, washing, dilute acids and alkalies. Used also in calico printing on a chromium mordant for greenish-yellow (rather sensitive to chlorine). Used to a considerable extent.
Anthracene Yellow paste and pdr. (By) Dibromodihydroxy-β-methyl-coumarin. No. 1018 (773)	An almost white paste. H_2O: Sparingly soluble. HCl to the diluted paste: Unaltered. NaOH: Brownish-yellow solution, white flocculent precipitate on acidification. H_2SO_4: Pale brownish solution, white precipitate on dilution. Dyes wool from an acid bath and after-chromed, or chrome-mordanted wool, greenish-yellow, moderately fast to light and milling. Light: 2. Used formerly for dyeing wool, but now used only for dyeing silk and in printing slubbing. The only pure silk yellow; used for flags.
Alizarine Black S, SRW, SW, WR paste or pdr.	*Alizarine Black S*— A black 20% paste with an odour of sulphur dioxide.

(BAC) (B) (B) Alizarine Blue-Black **SW, W, WB, extra paste or pdr.** (B) Naphthazarine **Naphthazarine S** 5:8-Dihydroxy-α-naphthaquinone, or hydroxy-juglone or its bisulphite compound. No. 1019 (774)	H_2O: Reddish-brown solution from which dihydroxy-naphthaquinone is liberated on heating. Alcohol: Yellowish-brown solution with a green fluorescence. HCl to aqueous solution: Unaltered. NaOH: Blue solution. H_2SO_4: Dull yellowish-green solution, converted into carmine-red with evolution of sulphur dioxide on heating, brownish solution and then brownish-black precipitate on dilution. Dyes chrome-mordanted wool, or wool from an acid bath and after-chromed, or wool from a single bath with metachrome mordant, reddish-black, fast to light milling, rubbing, potting, acids and alkalies. Used to a limited extent in calico printing; also for dyeing wool and silk fast black with chromium mordants. Naphthazarine is not used to any extent for dyeing cotton, owing to the difficulty of obtaining full shades.	**Note:** Competitors: Diamond Black S.V (By) and Erochrome Black T. (Gy).
Alizarine Black WX, WX extra, (*B*) 1:4:5:8-Tetrahydroxynaphthalene or leuconaphthazarine. No. 1020.	Light coloured needles when damp, or bluish needles when dry. H_2O: Sparingly soluble cold, bluish solution hot. NaOH: Red solution, converted by air-oxidation into a bluish-violet solution and metallic glistening precipitate. H_2SO_4: Red solution. Dyes wool and silk from a faintly acetic acid bath and after-chromed level black, fast to light, washing, milling and rubbing, and cotton mordanted with aluminium and exposed to air blue-black. Used for dyeing woollen piece-goods, yarn and slubbing. Scarcely used.	
Naphthopurpurin 5:7:8-Trihydroxy-α-naphthaquinone or its bisulphite compound. No. 1021	A brown crystalline powder, which crystallises from benzene in red needles. H_2O: orange-red solution. HCl: Brown crystalline precipitate. Na_2CO_3: Blood-red solution. NaOH: Magenta-red solution. H_2SO_4: Magenta-red solution, brown crystalline precipitate on dilution. Dyes wool from an acetic acid bath orange-red, converted by after-chroming into reddish-black, and cotton mordanted with chromium acetate fast black, superior to Naphthazarine (No. 1019). Not used.	

Alizarine Black SRA paste, (*B*) Possibly the bisulphite compound of 2-phenylamine-1:4:7:8-tetra-hydroxy-naphthalene. No. 1022	A brown paste. H_2O: Brown solution. NaOH: Green solution, converted into blue solution by air-oxidation. H_2SO_4: Dull brown solution, converted into violet on heating. Dyes cotton mordanted with chromium fast black, much faster to chlorine than Naphthazarine (No. 1019). Used in calico printing.	
Alizarine Dark Green W paste and pdr. (*B*) Possibly, 1:4:7:8-tetra-hydroxy-naphthalene-2-phenoxide. No. 1023 (775)	A greyish-brown powder. In alcohol: λ = about 630.5, 577.0, 529.5 and 491.5. H_2O: Moderately soluble with a violet colour. Alcohol: Violet-blue solution. NaOH: Greenish-blue solution. H_2SO_4: Violet-solution; redder solution and dark precipitate on dilution. Dyes chrome-mordanted wool, or preferably wool from an acid bath and after-treated with dichromate, dark yellowish-green, or after-treated with chromium fluoride, dark bluish-green, fast to light and milling, and of good fastness to acids and alkalies. Used for shading and saddening woollen piece-goods.	
Printing Blue for Wool (*B*) Components— 1:8-Dinitronaphthalene, glucose (or sodium sulphide), sodium bisulphite and sodium hydroxide. No. 1024 (742)	A violet-black powder with a metallic lustre. H_2O: Pure violet solution. Alcohol: Insoluble. NaOH to aqueous solution: Bluish-green solution. H_2SO_4: Blue solution with a green fluorescence. Dyes wool from an acid bath violet-blue. Used in printing wool.	
Printing Black for Wool (B) Components— 1:8- and 1:5-Dinitronaphthalene, glucose, sodium bisulphite and sodium hydroxide. No. 1025 (776)	A blue-black powder. H_2O: Readily soluble with a violet colour. Alcohol: Insoluble. NaOH to aqueous solution: Dull bluish-green solution. H_2SO_4: Blue solution, with a moss-green fluorescence. Dyes wool from an acid bath violet-black to black. Used in printing wool. Light: 2–1.	
Chromogen LL, C, I, (BDC) (CAC) (MLB) **Chromotropic Acid** Acid sodium salt of 1:8-dihydroxy-naphthalene-3:6-disulphonic acid. Chromothropic-Acid No. 1026 (777)	*Chromogen I*— A white powder or greyish-white powder. H_2O: Pale brown solution. HCl: Unaltered. NaOH: Unaltered. Ferric chloride: Grass-green coloration. H_2SO_4: Colourless solution, unaltered on dilution. Dyes wool from a boiling acid bath colourless, converted by after-chroming into yellowish-brown.	

	Level-dyeing 1; relation to cotton 1–2; relation to silk 2. Light: 2. Used for dyeing wool light and medium brown shades.

HYDROXY-ANTHRAQUINONES

No. 1027–1072

Hydroxy-Anthraquinones

The Hydroxyl derivatives of Anthraquinone form a very important group of mordant dyestuffs which are used especially for dyeing very fast shades on cotton, wool and, in a minor degree, on silk. They are prepared by different chemical reactions, but the most important is the old method of fusing sulphonic acids of anthraquinone with sodium hydroxyde and an oxidising agent, such as sodium nitrate or sodium chlorate. Another method consists in treating anthraquinone and its derivatives with fuming sulphuric acid (oleum); (Reaction of Bohn and Schmidt). Details are given in the excellent book on *Anthracene and Anthraquinone* by *E. de Barry-Barnett, London,* Baillière, Tindal and Cox, 1921. All the hydroxy derivatives of anthracene give anthracene when distilled with zinc dust (Reaction of Adolf v. Baeyer). See also the note on this point in the general introduction page 31. Some of the hydroxy anthraquinones given here are not dyes, but intermediates for Anthracene Dyes (Quinizarine, Anthrarufine, etc.).

Alizarine 1P, 1PB, 1PX, 2PX, BAR, MIP, NAC 20% paste, V, NB, N2B, N3B, B 20%, VI, I extra, Ie, No. 1, bluish I and Ia. (BAC) (GDC) (NAC) (SCI) (CN) (MDW) (B) (By) (MLB) (RW) 1:2-Dihydroxyanthraquinone. No. 1027 (778)	An ochre-yellow 20% paste; Alizarine melts at 289–290° and sublimes in long red needles when heated at a higher temperature. In potassium hydroxide: λ = about 612.0, 567.0 527.5. H_2O: Insoluble. Alcohol: Insoluble cold, yellowish-red solution on boiling. HCl to paste: Unaltered. NaOH: Violet solution. H_2SO_4: Deep yellowish-red solution, orange-yellow precipitate on dilution. Dyes cotton, mordanted with alumina in conjunction with lime red, or mordanted with tin pink, or mordanted with iron violet, or mordanted with chromium, puce-brown. Light: 1. Turkey Red is produced on cotton mordanted with Turkey red oil and alumina in presence of lime. Wool is mordanted with alum and

	cream of tartar, or with potassium dichromate and cream of tartar. Turkey Red is generally very fast to all agencies, but the fastness varies greatly according to the method of application. When a pattern of Turkey red is boiled with a solution of titanous sulphate and sodium tartrate, the colour is changed to greenish-blue, re-oxidised to red on exposure to air. Used also in calico printing in conjunction with various metallic mordants. Alizarine was the most important dyestuff for the production of red, pink and chocolate shades in dyeing and printing cotton, but its importance is gradually diminishing since the discovery of Naphthol A. S.	
Quinizarine 1:4-Dihydroxyanthraquinone. No. 1028	Quinizarine crystallises from alcohol in red needles or yellowish-red plates, M. P. 192–193°, and sublimes with partial decomposition at a high temperature. H_2O: Insoluble. λ (in $KOH + H_2O$) = 596.1; 553.7; 517.7. Ether: Soluble with a greenish-yellow fluorescence. NaOH: Blue solution. H_2SO_4: Soluble with a greenish-yellow fluorescence. Quinizarine is not used as a dye and possesses only about one-tenth the tinctorial power of Alizarine (No. 1027). Used for the manufacture of Alizarine Irisol (No. 1073), Alizarine Cyanol Violet R (No. 1074), Alizarine Cyanine Green (No. 1078), &c. Not on the market.	
Anthrarufine 1:5-Dihydroxyanthraquinone. No. 1029	Anthrarufine crystallises from glacial acetic acid in yellow needles or plates, M. P. 277–278°, and sublimes readily at a higher temperature. H_2O: Insoluble. λ (in $KOH + H_2O$) = not distinct. (in H_2SO_4) = 570.7 [557.7] 528.5; [517.7] [487.1] Ammonia: Sparingly soluble. NaOH: Olive-yellow solution. H_2SO_4: Intense crimson-red solution, orange precipitate on dilution. Used for the manufacture of Alizarine Saphirol (No. 1054), &c. Not on the market.	
Chrysazine 1:8-Dihydroxy-anthraquinone.	Chrysazine crystallises from alcohol in red needles with a bluish lustre, M. P. 193°.	

No. 1030	H_2O: Insoluble. In H_2SO_4 (red): λ = [533.0] 495.6. [465.9]. NaOH: Red solution; when Chrysazine is dissolved in a little hot dilute potassium hydroxide solution and filtered, a characteristic monopotassium salt crystallises from the filtrate in orange-red needles (Wölbling). H_2SO_4: Red solution. Used for the manufacture of dyes of the Alizarine Saphirol (No. 1054) and Anthraquinone Violet (No. 1080) type.	
α-Nitroalizarine (*MLB*) 4-Nitro-1:2-dihydroxy-anthraquinone. No. 1031	A brownish-yellow powder which crystallises from glacial acetic acid in brownish-yellow prismatic needles, M. P. 289° (decomp.). H_2O: Sparingly soluble with a bluish-red color. λ = one-sided in the blue. Alcohol: Yellowish-red solution. HCl to aqueous solution: Greenish-yellow flocculent precipitate. NaOH: Dark violet-red solution. H_2SO_4: Orange-red solution, yellow flocculent precipitate on dilution. Dyes cotton, mordanted with aluminium, orange-red, or mordanted with chromium, orange-brown, or mordanted with iron, reddish-purple. Not used as a dye. Used for the manufacture of Alizarine Garnet R (No. 1032). Of no importance.	
Alizarine Cardinal (By) Alizarine Claret R (MLB) *a-Aminoalizarine* 4-Amino-1:2-dihydroxy-anthraquinone. No. 1032 (797)	A carmine-red to reddish-brown paste; the dried paste crystallises from alcohol in small blackish needles with a faint greenish metallic reflex. In ethyl alcohol λ = 566.8, 526.3 and 490.8. H_2O: Insoluble. Alcohol: Carmine-red solution. HCl to paste: Brown colour. NaOH: Carmine-red solution. H_2SO_4: Brown solution, carmine-red precipitate on dilution. Dyes cotton, mordanted with aluminium, bluish-red, or mordanted with chromium, claret, or mordanted with iron, steel-blue. Light: 2. Used in calico printing and also for dyeing cotton and wool, particularly for shading Alizarine (No. 1027). Not important.	
Alizarine Orange AO pdr. and paste, RP paste, RR, N paste, (BAC) (NAC) (DH) (CM) (MLB)	*Alizarine Orange paste* (*MLB*)— A brownish-yellow 20% paste; the dried paste crystallises from benzene or glacial acetic acid in long, shining, orange-yellow needles or plates, M. P. 244° (decomp.).	

β-Nitroalizarine, 3-Nitro-1:2-dihydroxy-anthraquinone or its sodium salt. No. 1033 (779)	In potassium hydroxide λ = about 578.5, 534.0 and 495.5. H_2O: Insoluble. N_2CO_3: Magenta-red solution. NaOH: Magenta-red solution with one equivalent, but insoluble in excess; on adding zinc dust the colour changes through blue to yellowish-brown, but the blue colour returns on exposure to air. H_2SO_4: Yellowish-brown solution, light yellow precipitate on dilution. HNO_3: *id.* Dyes cotton, mordanted with aluminium, orange, or mordanted with chromium, reddish-brown, or mordanted with iron, reddish-violet. Light: 1–2. Used in calico printing and for the manufacture of Alizarine Blue (No. 1066); also for the manufacture of Alizarine Maroon (No. 1041) and for dyeing wool.
Alizarine Carmine (BAC) Alizarine Red S, NS, WS, IWS, (BAC) (MDW) (B) (By) (CN) (MLB) Sodium salt of 1:2-dihydroxyanthraquinone-3-sulphonic acid. No. 1034 (780)	An orange-yellow powder, which decomposes when heated strongly, and orange-red crystals of Alizarine are obtained by sublimation. H_2O: Yellowish-red solution. Alcohol: Yellow solution. HCl to aqueous solution: Light yellow solution. NaOH: Violet solution. H_2SO_4: Yellowish-red solution; light yellow solution on dilution. Dyes wool, mordanted with aluminium, scarlet-red, or mordanted with chromium, Bordeaux red, or mordanted with iron, dark violet; the shade is saddened by the use of copper dyeing vessels. Relation to cotton 2; relation to silk 2. Light: 1. Used for dyeing and printing woollen piece goods; also as an indicator for the estimation of alkali carbonates, ammonia, total alkali in soaps and the alkalinity of water (Knowles). One of the first fast wool reds.
Anthracene Brown OB, SO, G, WL paste, WLR, pdr., W paste, paste, DH paste, DH pdr., NI paste, NL pdr. GG, R, W, WG, WR,	*Anthracene Brown paste—* A dark brown 20% paste; the dried paste crystallises from alcohol in yellow needles; which sublime at 290°; M. .P 310°. H_2O: Insoluble. λ = 4. Not distinct absorbtion bands. Alcohol: Yellow solution. HCl to diluted paste: Unaltered. NaOH: Greenish-blue solution. H_2SO_4:

WGG paste, SW pdr., (BAC) (BAC) (B) (B D C) (L B H) (D u P) (DH) (CN) (B) (B) Anthracene Brown FD (for printing), FF (for dyeing), (Gy) (Gy) 1:2:3-Trihydroxy-anthraquinone. No. 1035 (782)	Brownish-red solution, brown flocculent precipitate on dilution. Dyes cotton, mordanted with chromium, brown. Cotton is also dyed well when mordanted with aluminium and tannin, or with aluminium, iron and tannin. Dyes wool, mordanted with chromium (preferably chromium fluoride), yellowish-brown to reddish-brown, fast to light, milling, stoving and dry-steaming. Light: 1. Used in **calico printing** and for dyeing cotton, wool and silk with a chromium mordant. **The best printing brown.**	
Erweco Alizarine Acid Red SB (*RW*) A mixture of the sodium salts of 1:2-dihydroxyanthraquinone-5-sulphonic acid and 1:2-dihydroxyanthraquinone-8-sulphonic acid. No. 1036 (781)	A crystalline powder. In water: Red only is transmitted. H_2O: Yellowish-red solution. Alcohol: Insoluble. HCl to aqueous solution: Rather lighter solution. NaOH: Bluish-violet solution. H_2SO_4: Orange solution, yellow solution on dilution. Dyes wool, mordanted with aluminium or chromium, Bordeaux red. Light: 1.	
Purpurine (BAC) (B) Alizarine No. 6 (**MLB**) 1:2:4-Trihydroxyanthraquinone. No. 1037 (783)	*Purpurine*— A reddish-brown paste; the dried paste crystallises from alcohol, ether, glacial acetic acid or benzene in red needles, which begin to sublime at 150°; M. P. 256°. In alcohol: λ = about 521.5, 485.7 and 455.5. H_2O: Very sparingly soluble and crystallises in orange-yellow needles. ($+H_2O$.) Alcohol: Sparingly soluble with an intense yellow to reddish-yellow colour. Ammonia or NaOH: Purple-red solution, redder than Alizarine (No. 1027), Flavopurpurine (No. 1039) or Anthra-purpurine (No. 1040), and rapidly decolorised by the action of light and air with formation of phthalic acid. H_2SO_4: Reddish solution, reddish-brown precipitate on dilution. Boiling alum solution: readily soluble with a yellowish-red colour and a green fluorescence. (Distinction between Natural Alizarine, which contains Purpurine, and Synthetic Alizarine.) Dyes cotton, mordanted with aluminium, scarlet-red, or mordanted with chro-	

	mium, reddish-brown, not so fast to light as Alizarine. Used mainly for the manufacture of Alizarine Blue-Black (No. 1085); also to a limited extent in calico printing for bluish-pink, moderately fast to light. *Alizarine Red PS*— A reddish-brown powder. H_2O: Readily soluble with a yellowish-orange colour. HCl: Orange solution. NaOH: Scarlet solution. H_2SO_4: Reddish-orange solution, scarcely altered on dilution. Dyes wool, mordanted with aluminium, much bluer than Alizarine Red S (No. 1034).	
Brilliant Alizarine Bordeaux R paste, (*By*) 1:2:5-Trihydroxyanthraquinone. No. 1038	An orange-yellow paste; the dried paste crystallises from glacial acetic acid in red needles, M. P. 273–274°. In sulphuric acid: Indistinct bands in the red, yellow and blue-green. In alcoholic alkali: Bands in the orange, yellow and green. λ = [619.5] $\underline{573.2}$; 533.5 (KOH + H_2O) λ = $\underline{636.0}$; [582.5] $\underline{505.8}$ in H_2SO_4. NaOH: Reddish-violet solution. H_2SO_4: Reddish-violet solution, orange-yellow precipitate on dilution; the reddish-violet solution is coloured blue by the addition of boric acid. Dyes cotton, mordanted with aluminium, bright bluish-red, or mordanted with chromium, bright bluish-violet. Cotton is also dyed excellently when mordanted with aluminium and tannin, or with aluminium, iron and tannin. Light: 1.	
Alizarine DCA, ICA, YCA, BCA, YAR, NF, GI, RG, VG, X, XG, XGG, SDG paste, yellowish No. V, (BAC) (GDC) (CN) (B) (By) (MLB) (RW) Flavopurpurin 1:2:6-Trihydroxyanthraquinone or hydroxyanthraflavic acid. No. 1039 (785)	A brownish-yellow 20% paste; the dried paste crystallises from alcohol in golden-yellow needles, M. P. 336°. H_2O_4: Insoluble cold, very sparingly soluble on boiling. λ (in H_2O + KOH) = [594.8] $\underline{551.0}$ [512.8]. Alcohol: Readily soluble when dry. Ammonia: Brown solution. NaOH: Violet solution. H_2SO_4: Reddish-brown solution, orange-yellow precipitate on dilution. Dyes cotton, mordanted with alumina and lime, red, yellower than Anthrapurpurine (No. 1040). Used particularly in **calico printing** in conjunction with various metallic mordants. Light: 1.	

Alizarine SC, SX, SAR, Y 20% paste, NA, Y 20%, GD, RF, WR, SX extra, RX, reddish SX extra. (BAC) (BAC) (B) (GDC) (NAC) (CN) (MDW) (B) (By) (MLB) (RW) Anthrapurpurin 1:2:7-Trihydroxy-anthraquinone or hydroxy-iso-anthraflavic acid. No. 1040 (784)	A brownish-yellow paste; the dried paste crystallises from alcohol in orange needles, M. P. 369°, insoluble in benzene. In potassium hydroxide λ = about [605.8] 561.8 and [523.0]. H_2O: Insoluble cold, very sparingly soluble on boiling. Alcohol: Readily soluble hot. Ammonia: Reddish-violet solution. NaOH: Bluish-violet solution. H_2SO_4: Brown solution, orange-yellow precipitate on dilution. Dyes cotton, mordanted with aluminum, scarlet-red, yellower than Alizarine (No. 1027), but not so yellow as Flavopurpurine (No. 1039). Used also in calico printing in conjunction with various metallic mordants. Light: 1.	
Alizarine Maroon, W paste and pdr. (*MDW*) (*B*) Mainly 3-amino-1:2:4-trihydroxy-anthraquinone, together with other isomerides and various amino-derivatives of 1:2-dihydroxy-anthraquinone. No. 1041 (798)	A dark violet-brown paste. In ethyl alcohol: λ = 567.2, 525.6, 489.5 and 460.0. H_2O: Insoluble. HCl to paste: Unaltered. NaOH: Violet solution. H_2SO_4: Red solution, brown precipitate on dilution. Dyes cotton, mordanted with aluminium, garnet-red, or mordanted with chromium, maroon, not so fast as most of the other alizarin-mordant dyes. Light: 2.	
β-Nitroflavopurpurine 3-Nitro-1:2:6-trihydroxyanthraquinone. No. 1042	A brownish-orange paste. H_2O: Insoluble. Alcohol: Readily soluble with an orange-yellow colour. HCl to diluted paste: Rather lighter in colour. NaOH: Blood-red solution. H_2SO_4: Orange-red solution, light orange-yellow precipitate on dilution. HNO_3: *id.* Dyes cotton or wool, mordanted with aluminium, orange, rather yellower than Alizarine Orange N (No. 1033) and of good fastness to light, chlorine, stoving, washing, milling, alkalies and acids. Used for the manufacture of **Alizarine Black P** (No. 1069).	
Pseudopurpurine **1:2:4-Trihydroxy-anthraquinone-3-carboxylic acid.** No. 1043	A red powder, which crystallises from chloroform in red glistening plates or needles, M. P. 222–224°, with evolution of carbon dioxide and formation of Purpurine (No. 1037). H_2O: Orange Solution. λ:? NaOH: Yellowish-red solution. H_2SO_4: Yellowish-red solution, converted into	

	bluish-red with a strong red fluorescence by the addition of boric acid. Used as an artist's colour in the form of its alumina lake. The finest and fastest red known.
Alizarine Red YWS SSS, 3WS, *(GDC) (B) (MLB)* Sodium salt of 1:2:6-trihydroxy-anthraquinone-3-sulphonic acid or of flavopurpurine-3-sulphonic acid. No. 1044 (786)	A yellowish-brown powder. H_2O: Yellowish-brown solution. Alcohol: Sparingly soluble with a yellow colour. HCl to aqueous solution: Light yellow solution. NaOH: Violet red solution. H_2SO_4: Orange-red solution; light yellow solution on dilution. Dyes wool, mordanted with chromium or aluminium, brownish-red. Light: 1. Little used.
Alizarine Bordeaux BA, B paste, BD paste, (BAC) (By) *Alizarine Cyanine 3R (By)* 1:2:5:8-Tetrahydroxy-anthraquinone. No. 1045 (787)	A brownish-red 20% paste; the dried paste crystallises from nitrobenzene in garnet-red needles with a green metallic reflex, which do not melt at 280°. In alcohol: *Alizarine Bordeaux B* (By): λ = 531.2, 518.0, 495.0, 485.2 and 460.5. H_2O: Insoluble. Alcohol: Brownish-orange solution. NaOH: Reddish-violet solution. H_2SO_4: Bluish-violet solution, brownish-red precipitate on dilution. Dyes cotton, mordanted with aluminium, bluish-Bordeaux red or claret red, or mordanted with chromium, dark violet-blue, fast to light, soap, chlorine and acids, or chrome-mordanted wool, or wool from a single bath with chromium fluoride, violet-blue, fast to light, milling, acids and alkalies. Light: 1. *Alizarine Bordeaux B* should not come into contact with copper vessels or copper salts during dyeing. Used for dyeing cotton and in calico printing; also to a less extent for dyeing wool and silk.
Anthrachrysazine 1:3:5:7-Tetrahydroxy-anthraquinone. No. 1046	A golden-yellow powder; the powder crystallises from alcohol in yellow silky needles, which do not melt at 360°. H_2O: Sparingly soluble. λ in KOH + H_2O = [451.0]; in H_2SO_4 504.8; [472.0]; $+B_2O_3$ = 512.8 [478.3]. Alcohol: Yellow solution. NaOH: Yellowish-red solution, from which the bright red sodium salt is deposited on adding 33% sodium hydroxide. H_2SO_4: Red solution. Valueless as a dye

	Used for the manufacture of Acid Alizarine Blue BB (No. 1063), &c.
Dinitroanthrachrysone disulphonic acid (*MLB*) Sodium salt of 4:8-dinitro-1:3:5:7-tetrahydroxyanthraquinone-2:6-disulphonic acid. No. 1047	A greenish-yellow powder. H_2O: Yellow solution. Alcohol: Readily soluble. HCl to aqueous solution: Scarcely altered. NaOH: Reddish-orange solution. H_2SO_4: Brownish-yellow solution; yellow solution on dilution. Dyes wool from an acid bath and afterchromed, or chrome-mordanted wool, level brown, fast to light and milling. Used also in Vigoureux printing. Scarcely used.
Acid Alizarine Blue GR (*MLB*) Sodium salt of 4:8-diamino-1:3:5:7-tetrahydroxyanthraquinone-2:6-disulphonic acid. No. 1048	A brownish-black powder. H_2O: Sparingly soluble with a violet-red colour. λ: not determined. Alcohol: Insoluble. HCl to aqueous solution: Red solution. NaOH: Bluish-violet solution and then flocculent bluish-violet precipitate. H_2SO_4: Brownish-red solution; red solution on dilution. Dyes wool from an acid bath violet, or wool mordanted with chromium, blue, or mordanted with aluminium, violet-blue. Light: 1–2.
Acid Alizarine Green B, G, (MLB) Probably, sodium salt of 4:8-dimercapto-1:3:5:7-tetrahydroxyanthraquinone-2:6-disulphonic acid. No. 1049 (796)	Reddish-black to greenish-black crystalline powder. H_2O: bluish-green solution. λ = not distinct, several bands. Alcohol: insoluble. HCl to aqueous solution: reddish-blue solution. NaOH: violet solution and soluble reddish-violet precipitate. H_2SO_4: B, violet solution with a strong red fluorescence, violet-red solution on dilution; G, pure blue solution, violet solution and then bluish-green solution on dilution. HNO_3: purple. Dyes wool from an acid bath greenish-blue, converted by after-chroming into pure green.
Alizarine Cyanine AG, 2R, NS, NSV paste, R, RA extra, WRN. (**BAC**) (**By**) Mainly 1:2:4:5:8-pentahydroxyanthraquinone. No. 1050 (788)	A dark brown paste; the dried paste crystallises from nitrobenzene in bronzy leaflets. In alcoholic hydrochloric acid: *Alizarine Cyanine R* (By): λ = 603.0, 568.3, 546.4, 533.7, 522.1, 508.8, 497.0, 486.8, 476.5 and 465.5. H_2O: Insoluble. Glacial acetic acid: Yellowish-red solution with a green fluorescence. NaOH: Blue solution. H_2SO_4: Blue solution with a red fluorescence, dark brown precipitate on dilution.

	Dyes cotton, mordanted with chromium, reddish-blue, or mordanted with aluminium, reddish-violet, fast to light, washing, alkalies and acids, and chrome-mordanted wool, or wool from a single bath with chromium fluoride blue, fast to light, milling, alkalies and acids. Light: 1–2. Used also in calico printing with an aluminium mordant.
Alizarine Cyanine G paste, G extra, GG, RR, WRB (By) Probably, 5:8-diamino-1:2:4-trihydroxyanthraquinone, together with some of its 6- or 7-hydroxy-derivatives. No. 1051 (799)	A black paste. H_2O: Insoluble. λ in alcohol = 591.0; 547.5 in H_2O; 587.6; Alcohol: Bluish-violet solution. NaOH or ammonia: Greenish-blue solution. H_2SO_4: Currant-red solution, dark precipitate on dilution. Dyes wool, mordanted with chromium, bluish-green, or mordanted with aluminium, blue, fast to light, milling, acids and alkalies. Light: 1–2. A very important dye.
Rufigallol (B) *Rufigallic Acid* 1:2:4:5:6:7-Hexahydroxyanthraquinone. No. 1052	A brownish-red powder which sublimes in yellow needles. H_2O: Insoluble. λ in H_2SO_4 = 572.5 [530.3] [457.0]. HCl: Unaltered. NaOH: Blue solution which changes rapidly in the air. H_2SO_4: Red solution. Dyes chrome-mordanted wool brown, insufficiently pure in tone to be of value. Compare the dyeing properties of the isomeride, Anthracene Blue WR (No. 1062).
Alizarine Saphirol SE Alizarine Delphinol SEN (BDC) (BY) Sodium salt of 4:8-diamino-1:5-dihydroxyanthraquinone-2-sulphonic acid. No. 1053	A greyish-blue powder. H_2O: Blue solution. λ = about 576.0; always mixed with Saphirol B. Alcohol: Partly soluble with a blue colour. HCl to aqueous solution: Bordeaux red precipitate. NaOH: Brighter blue solution. H_2SO_4: Brownish-yellow solution, Bordeaux precipitate on dilution. Dyes wool from an acid bath level bright blue, fast to light, dilute acids and salt, less sensitive to salt or perspiration, and less readily marked by dropping water than Alizarine Saphirol B (No. 1054), or chrome-mordanted wool greenish-blue, fast to light, milling, potting and alkalies. The most used Alizarine Saphirol. Light: 1.
Anthracene Blue BDG paste and pdr. BB paste, BB pdr., BR paste, BR pdr.	*Anthracene Blue WG*— A bluish-black paste. H_2O: Violet-blue solution on boiling; *Anthracene Blue WB*, insoluble.

(BDC) (LBH) Anthracene Blue, WB, WG, (*MDW*) (*B*) Components— 1:5-Dinitroanthraquinone, fuming sulphuric acid and sulphur. No. 1059 (800)	NaOH: Greenish-blue solution. H_2SO_4: Reddish-brown solution. λ = 534.5 for W.G. Dyes wool, mordanted with aluminium, pure blue (WB greenish-blue), or mordanted with chromium bluish-green. Light: 1.
Alizarine Saphirol B, Alizarine Delphinol B, BDN (BDC) Alizarine Brilliant Blue B. (LBH) NSE, (GCC) (By) (CN) Sodium salt of 4:8-diamino-1:5-dihydroxyanthraquinone-2:6-disulphonic acid. No. 1054 (858)	A greenish-black powder. In water: λ = [642.8] 589.5; 548.5 (not sharp). H_2O: Blue solution. HCl: Redder solution and soluble precipitate. NaOH: Scarcely altered. H_2SO_4: Yellow solution; red solution, violet solution and then blue solution on dilution. Dyes wool from an acid bath level reddish-blue, fast to light, but not fast to salts or perspiration, and marked by dropping water, or chrome-mordanted wool greener and duller blue of good fastness to light, milling, potting and alkalies. Relation to cotton, 1. Used for dyeing woollen piece-goods and in printing piece-goods and slubbing; also to a very limited extent for dyeing cotton and in calico printing with an aluminium mordant. An excellent blue. Unsuitable for silk.
Alizarine Direct Blue EB **(MLB)** Sodium salt of 4:8-diethylamino-1:5-dihydroxyanthraquinone-2:6-disulphonic acid and of 4:5-diethylamino-1:8-dihydroxy-anthraquinone-2:6-disulphonic acid. No. 1055	A violet powder. H_2O: Deep blue solution. λ for B = 591.0; 643.8 549.5 λ for G.B = 587.0; 641.0 545.5 Alcohol: Sparingly soluble with a blue colour. HCl to aqueous solution: Reddish-violet precipitate. NaOH: pure blue solution. H_2SO_4: Brownish yellow solution; reddish-brown solution and then violet solution on dilution. Dyes wool and silk from an acid bath level blue, intermediate between Alizarine Saphirol B (No. 1054) and Alizarine Saphirol SE (No. 1053) in fastness to perspiration. The shade is unaltered in artificial light. Light: 1.
Alizarine Emeraldol G paste, **(By)** Probably, sodium salt of 4:8-dimercapto-	A blackish-green powder. H_2O: Bluish-green solution. λ = 692.9; 640.4; [588.1]. Alcohol: Insoluble. HCl to aqueous solution: Scarcely altered. NaOH:

1:5-dihydroxy-anthraquinone-2:6-disulphonic acid. No. 1056	Greenish-blue precipitate. H_2SO_4: Reddish-brown solution; red solution, violet solution and then bluish-green precipitate on dilution. Dyes wool and silk from an acid bath, moderately level bluish-green, moderately fast to light and washing. The self-shade tends to become bluer on exposure, but Alizarine Emeraldol G is very fast to light in compound shades. Light: 2. Used for dyeing woollen piece-goods.
Brilliant Anthrazurol G, (B) Alizarine Celestol R pdr. (*By*) No. 1057	*Brilliant Anthrazurol G* (B)— A greyish-green powder. H_2O: Pure blue solution. λ = 635.5; 584.5; 548.5. Alcohol: Greenish-blue solution. HCl to aqueous solution: Brown solution. NaOH: Unaltered. H_2SO_4: Reddish-brown solution, reddish-brown precipitate on dilution. Dyes wool from an acid bath blue, or chrome-mordanted wool greenish-blue. Light: 1–2.
Alizarine Uranol BB, R (By) No. 1058 See Forz: *Dyestuffs* [1926] p. 519	*Alizarine Uranol R*— A blue powder. H_2O: Blue solution. λ for R = 6278; 5800. Red fluorescence. Alcohol: Blue solution. HCl to aqueous solution: Violet precipitate, or red precipitate with excess. NaOH: Brighter blue solution. H_2SO_4: Violet solution; magenta-red solution and then violet precipitate on dilution. Dyes wool from an acid bath bright blue, fast to light. Light: 1–2. Relation to cotton, 1.
Anthracene Blue WGG, WGG extra, (B) Brilliant Alizarine Cyanine G, 3G (By) Sodium salts of a complex mixture of isomeric diamino-dihydroxy-anthraquinone sulphonic acids. No. 1060 (801)	A blue-black powder or paste. H_2O: Blue solution hot. In alcohol: λ = 546.4; 592.5; 533.7; 508.8; 497.0 for W.G.G. HCl: Blue solution hot. NaOH: blue solution. H_2SO_4: Brownish-yellow solution. Dyes wool from an acid bath bluish-violet, and chrome-mordanted wool, or wool from an acid bath and after-chromed bluish-green, fast to light, and moderately fast to milling and acids.
Anthracene Blue WG new, (B) Components— Anthracene Blue WG (No. 1059), sodium hydroxide and	A bluish-black paste, or bronzy glistening powder when dry. H_2O: Almost insoluble. In alcohol, λ = 604.5; 566.2; 546.4; 533.7; [522.1] 508.8; 497.0 [486.8] [476.5] [465.5]. Alcohol: Violet solution. NaOH: Pure blue solution. H_2SO_4: Yellowish-red solution.

ammonia. No. 1061 (802)	Dyes chrome-mordanted wool greenish-blue, very fast to milling. Light: 1–2.	
Anthracene Blue W, R, Alizarine Cyanine WRR (By) Anthrol Blue NR paste (MLB) Mainly 1:2:4:5:6:8-hexahydroxy-anthraquinone. **No. 1062** (789)	A blackish-brown powder or paste. In alcohol: *Anthracene Blue WR* (B): λ = 569.5, 560.3, 546.4, 533.7, 522.1, 508.8, 497.0, 486.8, 476.5 and 465.5. H_2O: Insoluble. Alcohol: Red solution with a yellow fluorescence. NaOH: Blue solution. H_2SO_4: Violet-blue solution with a brownish-red fluorescence. Dyes wool, mordanted with chromium, blue, fast to light and moderately fast to milling and acids, or wool mordanted with aluminium, violet, not so fast as the blue obtained with chromium. **The most important dye of this class.**	
Anthracene Blue SWX, SWX extra, (B) Acid Alizarine Blue BB (MLB) Sodium salt of 1:2:-4:5:6:8-hexahydroxy-anthraquinone-3:7-disulphonic acid. No. 1063 (790)	A dark red or light red crystalline powder. In water: *Anthracene Blue SWX* (B): λ = 549.0, 535.5, 510.0, 499.0 and 476.0. H_2O: Red solution. Alcohol: Insoluble. HCl to aqueous solution: Reddish-violet precipitate. NaOH: Violet-blue solution and precipitate with excess. H_2SO_4: Bluish-red fluorescent solution; red solution on dilution. Dyes wool from an acid bath cherry-red, converted by after-treatment with chromium fluoride into pure blue. Light: 1–2. Used mainly for dyeing woollen yarn and piece-goods.	
Alizarine Cyanine R extra, **(By)** 1:2:4:5:7:8-Hexahydroxyanthraquinone. No. 1064	A blackish-brown powder or paste. In sulphuric acid: Band in the red. λ = 552.0; 507.0 H_2O: Insoluble. NaOH: Greenish-blue solution. H_2SO_4: Blue solution. Dyes wool, mordanted with aluminium, reddish-violet, fast to light and washing, or mordanted with chromium, blue, greener than No. 1062. Used in calico printing with aluminium or chromium mordants, and particularly for upholstery-cloths. Light: 1–2.	
Alizarine Cyanine Black G pdr. and paste, (*By*) 3-Nitro-1:2:4:5:7:8-hexahydroxyanthraquinone. No. 1065.	A black powder. H_2O: Reddish-brown solution. Alcohol: Insoluble. HCl to aqueous solution: Brown precipitate. NaOH: Blue precipitate. H_2SO_4: Reddish-violet solution; red solution and then reddish-brown precipitate on dilution.	

	Dyes wool from an acid bath and afterchromed bluish-black, fast to light, milling, dry-steaming and stoving, and moderately fast to acids. Greener shades are obtained with chromium fluoride than with dichromate; the shades do not acquire a red tint in gas-light. Light: 1–2. Used also in calico printing with chromium and calcium acetates for greenish-grey, bluish-grey, or bluish-black shades, fast to light.
Alizarine Blue ABI, SCB paste, R 20%, C, R, RR, WC, WN double new paste, WR, WRR, WX, X, BM, G, GG, GW, R paste, A, F, R, RR paste, (BAC) (MDW) (B) (By) (MLB) Alizarine Indigo Blue (Z) 1:2-Dihydroxyanthraquinone-β-quinoline, or alizarine-β-quinoline. No. 1066 (803)	A blackish-blue 20% paste, or dark blue crystalline powder when dry, which crystallises from benzene in brownish-violet needles, M. P. 270°, and sublimes in an orange-red vapour; the sodium salt is a bright blue 20% paste. λ in $H_2O + KOH$ = 567.5; 526.9 491.9. H_2O: Insoluble; the sodium salt is sparingly soluble. Alcohol: Slightly soluble with a blue colour on boiling. HCl to hot alcoholic solution: Yellowish-red solution of the hydrochloride which is decomposed by water. NaOH to hot alcoholic solution: Green solution. H_2SO_4: crimson-red solution; yellowish-red solution on dilution. Alizarine Blue is converted into anthraquinoline, $C_{n3}H_{n}N_{3}$, when heated with zinc dust. Dyes chrome-mordanted wool, silk and cotton reddish-blue. Light: 2–1. The finest blues are obtained with zinc and nickel mordant. Alizarine Blue forms a calcium lake insoluble in water, but this is prevented during dyeing by the addition of acetic acid. Relation to cotton, 4; relation to silk, 3. Used largely for dyeing uniform-cloth and for the manufacture of Alizarine Blue S (No. 1067).
Alizarine Blue ABS, NS, S, SW, SR, SRW, (BAC) (CN) (MDW) (B) (By) (B) (By) (B) (By) (MLB) (B) (MLB) Sodium bisulphite compound of 1:2-dihydroxy-anthraquinone-β-quinoline. No. 1067 (804)	Brown crystalline paste (15%), or chocolate-brown powder (50%). H_2O: Yellowish-brown solution which decomposes when heated above 70° with precipitation of insoluble Alizarine Blue (No. 1066). Alcohol: Insoluble. HCl to aqueous solution: Redder-yellow solution with decomposition. NaOH: Bluish-violet solution with decomposition. H_2SO_4: Dark yellow solution, with evolution of sulphur dioxide, brown precipitate on dilution.

	Dyes chrome-mordanted wool, silk and cotton reddish-blue, fast to light, milling, acids, stoving and dry-steaming. The major portion of the colour is taken up by the fibre at 55–65°, and on heating above 70° the bisulphite compound is decomposed and the Alizarine Blue combines gradually with the mordant; if the temperature is raised too high too quickly the shade is neither level nor fast to rubbing. Light: 2–1. Used in dyeing and printing as a substitute for Indigo. Used for Japanese marine uniforms. The only blue for wool which is **fast to sea water.**	For printing the *nickel-zinc*-lake is used.
Alizarine Green S paste (*MLB*) Sodium bisulphite compound of 1:2-dihydroxy-anthraquinone α-quinoline. No. 1068 (805)	A bluish-red crystalline paste. In sulphuric acid: $\lambda = \underline{634.0}$, 583.5 and 542.5. H_2O: Readily soluble with a reddish-violet colour. Alcohol: Insoluble. HCl to aqueous solution: Greenish-grey precipitate. NaOH: Carmine-red solution. H_2SO_4: Cherry-red solution with evolution of sulphur dioxide, bluish-green precipitate of the sulphate on dilution. Dyes cotton mordanted with chromium, or chrome-mordanted wool not very bright bluish-green. Light: 2–1. Used in calico printing, preferably with a nickel-magnesium mordant; also for dyeing and printing silk. Has been replaced by Coerulein.	
Alizarine Black P paste, (**MLB**) 1:2:6-Trihydroxy-anthraquinone-β-quinoline or flavopurpurin-β-quinoline. No. 1069 (806)	A greenish-black paste. H_2O: insoluble. Alcohol: Sparingly soluble. HCl: The paste becomes brown. NaOH: Deep dull green solution. H_2SO_4: Dull reddish-brown solution, light brown solution and then brown precipitate on dilution. Dyes chrome-mordanted wool and cotton violet-grey to black, fast to light, milling, washing, acids and chlorine. Light: 1. Used for dyeing wool and in **calico printing** with a chromium mordant.	
Alizarine Black S (**MLB**) Sodium bisulphite compound of 1:2:6-trihydroxyanthraquinone-β-quinoline. No. 1070 (807)	A brownish-black paste, or dark brown solution. H_2O: Brown solution. HCl: Black precipitate. NaOH: Blackish-violet solution. H_2SO_4: Brown solution and evolution of sulphur dioxide, brown precipitate on dilution.	

	Dyes chrome-mordanted wool or cotton violet-grey to black, fast to light, milling, washing, acids and chlorine. Light: 1–2. Used mainly in **calico printing.** Important.	
Alizarine Green X paste, WX paste and pdr. (*BAC*) (*B*) (*B*) Mainly a monosulphonic acid of amonohydroxy-derivative of 1:2-dihydroxyanthraquinone-β-quinoline, together with some dihydroxy-derivative of the latter. No. 1071 (808)	*Alizarine Green S*— A brownish-black paste, or dark brown liquid with an odour of sulphur dioxide. In sulphuric acid: *Alizarine Green X paste* (B): λ = 623.3, 579.5 and 538.9. H_2O: Orange to reddish-brown solution, decomposed on boiling, with precipitation of Alizarine Green X. NaOH: Bluish-violet solution, dark green precipitate on boiling. HCl: Unaltered cold, dark blue precipitate and evolution of sulphur dioxide on boiling. H_2SO_4: *Alizarine Green X:* Dark bluish-violet solution, reddish-brown precipitate on dilution. Dyes chrome-mordanted wool bluish-green, fast to light, washing, milling, acids, stoving and dry-steaming. Light: 1. Used also in calico printing and for dyeing silk.	
Alizarine Indigo Blue S, SW, SMW paste and pdr. (**B**) Bisulphite compound of 1:2:5:7:8-pentahydroxyanthraquinone-β-quinoline and an isomeride, together with some 1: 2: 5: 8-tetrahydroxyanthraquinone-β-quinoline. No. 1072 (809)	*Alizarine Indigo Blue S*— A brownish-black paste, or dark reddish-brown liquid. H_2O: Brownish-red solution, decomposed on boiling with precipitation of Alizarine Indigo Blue. λ: not known. HCl: Unaltered cold, dark blue precipitate and evolution of sulphur dioxide on boiling. NaOH: Blue solution. H_2SO_4: **Alizarine Indigo Blue:** Blue solution, reddish-violet precipitate on dilution. Dyes chrome-mordanted wool fast indigo-blue. Light: 1. Used also in calico printing.	

ACID ANTHRAQUINONE DYES

No. 1073–1093

Acid Anthraquinone Dyes

This group is the group of the near future, because it comprises individuals having very brilliant shades coupled with almost absolute fastness towards light. These dyestuffs are therefore very often met with, and all the important dyestuff manufactures are compelled to produce these colours. As a rule, they give anthracene on distil-

lation with zinc dust, and they are reduced by hydrosulphite, giving invariably a yellowish coloration which, as a rule, is not completely reoxidised by air to the original dyestuffs. Green's remark (see his *Analysis*) that Cyananthrole is a mixture is erroneous, and probably due to the well-known fact that uniform acid anthracene dyes on reduction and reoxidation can give different oxidation products. The Spectroscope is most useful in identifying these substances.

Alizarine Irisol D, R pdr. and paste, (By) Quinizarine Blue Sodium salt of 1-hydroxy-4-*o*-sulpho-*p*-tolylamino-anthraquinone. No. 1073 (852)	*Alizarine Irisol R*— A reddish-blue powder or paste In alcohol: λ = 609.0, 563.6 and 526.0. H_2O: Reddish-blue solution. HCl: Reddish-blue precipitate. NaOH: Greenish-blue precipitate. H_2SO_4: Bright blue solution, reddish-blue precipitate on dilution. Dyes wool and silk from an acid bath, or from a neutral bath, bright bluish-violet, converted into greenish-blue by after-chroming, but the latter shade is not used. Level-dyeing 3; relation to cotton 1; relation to silk 4–3. Used for dyeing piece-goods, slubbing and yarns lilac or heliotrope shades. Light: 1. Discharged yellow by hydrosulphite.	
Alizarine Cyanol Violet R (C) Alizarine Direct Violet R (**MLB**) Sodium salt of 1-hydroxy-4-*m*-sulpho-*p*-tolylaminoanthraquinone. No. 1074 (852)	*Alizarine Cyanol Violet R*— A violet powder. H_2O: Sparingly soluble cold, violet solution hot. λ = 561.5. Alcohol: Partly soluble with a violet colour. HCl to aqueous solution: tion: Violet precipitate. NaOH: Blue solution and blue precipitate. H_2SO_4: Dichoric blue solution; olive-brown solution, blue solution and then violet precipitate on dilution. Dyes wool and silk from an acid bath level violet, fast to light, rendered bluer by after-chroming.	
Alizarine Celestol B, (BDC) Alizarine Astrol B, G, (By) Sodium salt of 1-methylamino-4-*o*-sulpho-*p*-tolyl-aminoanthraquin-	*Alizarine G* (By)— A blue powder. In H_2O: λ = 661.9; 608.7; [565.8(?)]. In alcohol: λ = 664.1, 609.9 and 564.0. H_2O: Greenish-blue solution. HCl: Reddish precipitate. NaOH: Greenish-blue precipitate. H_2SO_4: Blue solution; magenta-red solution and then reddish precipitate on dilution. Dyes wool and silk from an acid bath, or from a neutral bath, level greenish-blue of excellent fastness to light; (not	

one. No. 1075 (856)	so fast to light as Nos. 1053, 1054, 1055), unaffected by salt or perspiration, and unaltered in shade by after-chroming but rendered faster to milling. Light: 2. Used for dyeing woollen piece-goods, silk and unions of wool and silk; also in printing wool and silk. *Alizarine Astrol G* is more soluble than the B brand, and is used ony in printing. Discharged to yellowish-orange by Hydrosulphite.	
Cyananthrol R, RA, RB (B) Sodium salt of 1-amino-2-methyl-4-*o*-sulpho-*p*-tolylamino-anthraquinone. No. 1076 (859)	A reddish-violet powder. In alcohol: λ = 623.3, 577.0 and 535.7. H_2O: Blue solution. Alcohol: Partly soluble with a blue colour. HCl to aqueous solution: Red solution and blue precipitate. NaOH: Blue solution and blue precipitate. H_2SO_4: Reddish-violet solution; crimson-red solution on dilution. Dyes wool and silk from an acid bath level reddish-blue, fast to light, unaffected by salt or perspiration, and rendered faster to milling by after-chroming. Light: 1–2. Used for dyeing woolen piece-goods.	
Cyananthrol G (B) **A derivative of methyl-anthraquinone of a similar type to No. 1076.** No. 1077 (860)	A greyish-blue powder. H_2O: Blue solution. λ: not known. Alcohol: Partly soluble hot, with a blue colour. HCl to aqueous solution: Reddish-violet solution. NaOH: Blue precipitate and solution. H_2SO_4: Reddish-violet solution; red solution and then reddish-violet solution on dilution. Dyes wool and silk from an acid bath greenish-blue, fast to light, acids and dry-steaming, and rendered faster to milling by after-chroming. Light: 1–2.	
Alizurol Cyanine Green E, G extra, K (BAC) Alizarine Cyanine Green F paste and pdr. E. Pdr, EF, G extra, 3G, K pdr. and paste, (BDC) (By) **Quinizarine Green**	*Alizarine Cyanine Green G extra*— A bluish-green powder. In ethyl alcohol: *Alizarine Cyanine Green* E pdr.: λ = 650.7, 596.4 and 532.2. H_2O: Bluish-green solution. HCl: Dark soluble precipitate. NaOH: Dark soluble precipitate. H_2SO_4: Dull reddish-blue solution; bluish-green solution on dilution. Dyes wool from an acid bath yellowish-green to bluish-green, unaltered in shade but rendered faster to milling by after-chroming, or chrome-mordanted wool, or wool from a single bath with metachrome mordant, and wool and silk from a neutral bath.	

Note: The statements of the Colour Index to the effect that 1075 is faster than 1053/55 **is not correct.**

Sodium salt of 1:4-di-*o*-sulpho-*p*-tolyl-aminoanthraquinone. No. 1078 (865)	*Alizarine Cyanine Green E* is not so bright as the G brand and *Alizarine Cyanine Green K* possesses better level-dyeing properties than the G brand. Level-dyeing 4; relation to cotton, 1–2; relation to silk, 2–3. Light: 1–2. Used also for dyeing silk with aluminium and iron mordants.	
Alizarine Brilliant Green G (C) Alizarine Direct Green G (MLB) Sodium salt of 1:4-di-*m*-sulpho-*p*-tolylaminoanthraquinone. No. 1079 (865)	*Alizarine Brilliant Green G* (*C*)— A blackish-green powder. In ethyl alcohol: λ = 645.8, 591.4 and 546.5. H_2O: Dark bluish-green solution. Alcohol: Blue solution. HCl to aqueous solution: Bluish-green flocculent precipitate. NaOH: Bluish-green flocculent precipitate. H_2SO_4: Blackish-green solution; violet solution and then bluish-green precipitate on dilution. Dyes wool from an acid bath green. Purer in shade than 1078.	
Anthraquinone Violet B, (LBH) Anthraquinone Violet (B) Sodium salt of 1:5-di-*o*-sulpho-*p*-tolylaminoanthraquinone. No. 1080 (853)	A dark bluish-violet powder. H_2O: Reddish-violet solution. λ: not sharp. Alcohol: Red solution. HCl to aqueous solution: Reddish-violet precipitate. NaOH: Unaltered, or soluble violet precipitate. H_2SO_4: Brown solution, reddish-violet precipitate on dilution. Dyes wool and silk from an acid bath moderately level violet of good fastness to light and acids, unaltered in shade but rendered faster to milling by after-chroming. Used as a bottom for marine blue. Light: 1–2.	
Anthraquinone Green GX, GXN (*B*) Sodium salt of 1-sulpho-phenylamino-4-phenylaminoanthraquinone-6-sulphonic acid. No. 1081 (864)	*Anthraquinone Green GX*— A greenish-black powder. H_2O: Green solution. λ = 658.1, 605.8. Alcohol: Partially soluble with a green colour. HCl to aqueous solution: Green precipitate. NaOH: Green precipitate. H_2SO_4: Dull violet-blue solution, grass-green precipitate on dilution. Dyes wool and silk from an acid bath moderately level yellowish-green, fast to light and of good fastness to alkalies, little altered in shade but rendered faster to milling by after-chroming. Light: 1–2. *Anthraquinone Green GXN* (*B*) possesses greater solubility and dyes more level shades of bright green, fast to light, of good fastness to acids and alkalies, and of moderate fastness to washing,	

	rendered faster to washing and milling by after-chroming.	
Anthraquinone Blue-Green BXO (*B*) Sodium salt of 1:4-di-*m*-sulpho-phenylaminoanthraquinone-6-sulphonic acid. No. 1082 (863)	A greyish-black powder. In H_2O: $\lambda = \underline{654.5}; \underline{601.0}; 557.0$. In alcohol and acid: $\lambda = \underline{649.7}$, 596.1 and 551.5. H_2O: Bluish-green solution. Alcohol: Insoluble. HCl to aqueous solution: Unaltered. NaOH: Unaltered. H_2SO_4: Blue-black solution; green solution on dilution. Dyes wool and silk from an acid bath bluish-green, fast to light and of good fastness to milling and alkalies, scarcely altered in shade, but rendered faster to milling by after-chroming. Light: 1–2.	
Brilliant Alizarine Viridine F paste and pdr. (By) Sodium salt of a sulphonic acid of 1:4-di-*p*-tolylamino-5-hydroxyanthraquinone. No. 1083 (854)	A dark green powder. In water: $\lambda = \underline{672.3}$ and $\underline{616.2}$. H_2O: Bluish-green solution. HCl: Dark yellowish-green precipitate. NaOH: Bluer solution and bluish-green precipitate. H_2SO_4: Dull blue solution, yellowish-green precipitate on dilution. Dyes chrome-mordanted cotton green, fast to washing and light. Light: 1–2. Used for dyeing chrome-mordanted cotton, and in calico printing with chromium acetate.	
Alizarine Viridine DG, FF, (By) Sodium salt of 1:4-di-*o*-sulpho-*p*-tolylamino-7:8-dihydroxyanthraquinone. No. 1084 (854)	*Alizarine Viridine FF* (*By*)— A dark green powder. H_2O: Dark green solution. $\left\{ \lambda = \begin{array}{l} \underline{665.5} \\ \underline{608.7} \\ 562.9 \end{array} \right.$ Alcohol: Partly soluble, with a bluish-green colour. HCl to aqueous solution: Unaltered. NaOH: Blue solution. H_2SO_4: Dark green solution; green solution on dilution. Dyes chrome-mordanted cotton, wool and silk green fast to light and washing. Used mainly in calico printing with chromium acetate. Discharged by chlorate on cotton. An important product.	
Alizarine Blue-Black NB, B, 3B, G, (CN) (By) Salicine Blue-Black B (K) Sodium salt of 3:4-	*Alizarine Blue-Black B*— A black-brown powder. H_2O: Dark reddish-violet solution. HCl: Soluble reddish-violet precipitate. NaOH: Violet-blue solution. H_2SO_4: Violet solution; turbid reddish-violet solution on dilution. Dyes wool from an acid bath reddish-grey, converted by after-chroming into level blue-black, and chrome-	

or 2:4-di-sulpho-phenylamino-1-hydroxy-anthra-quinone. No. 1085 (862)	mordanted wool and silk fast grey to blue-black. Light: -1. Used largely for dyeing wool grey, slate, &c., shades. **One of the most important products in this class.**
Erweco Acid Alizarine Blue R (*RW*) Sodium salt of 1:5-di-phenylamino-2:6-di-hydroxyanthraquin-one-3:7-disulphonic acid. No. 1086 (857)	A dark blue powder. H_2O: Violet solution. λ = not sharp. Alcohol: Insoluble. HCl to aqueous solution: Redder solution. NaOH: Deep blue solution. H_2SO_4: Discoloured solution. Dyes wool from an acid bath violet-red, converted into fast deep blue by after-chroming. Light: 1.
Alizarine Cyanol B (C) Alizarine Direct Blue B (**MLB**) Mixture of the sodium salts of 1-amino-2-bromo-4-sulpho-phenylamino-anthra-quinone-5-sulphonic acid and 1-amino-2-bromo-4-sulpho-phenylamino-anthra-quinone-8-sulphonic acid.	*Alizarine Direct Blue B* (MLB)— A blue powder. In alcohol: λ = 634.4, 585.8 and 543.5. H_2O: blue solution. Alcohol: Blue solution. HCl to aqueous solution: Violet-blue precipitate. NaOH: Blue precipitate. H_2SO_4: Faintly coloured greyish-blue solution; red solution, red precipitate, violet precipitate and then blue precipitate on dilution. Dyes wool from an acid bath bright blue, fast to light. Light: 1-2. Same properties as *Alizarine Pure Blue B.*
No. 1087 (851) (**By**) Alizarine Sky Blue B (LBH) (By) Alizarine Pure Blue B Sodium salt of 1-amino-2-bromo-4-*o*-sulpho-*p*-tolylamino-anthra-quinone. No. 1088 (855)	A dark reddish-blue powder. In alcohol: λ = 643.1, 588.3 and 549.5. H_2O: Sparingly soluble cold, readily soluble hot with a blue colour. HCl: Blue precipitate. NaOH: Greenish-blue precipitate. H_2SO_4: Dichroic blue solution; red solution and then blue precipitate on dilution. Dyes wool and silk from an acid bath moderately level bright blue fast to light and moderately fast to alkalies and potting, unaltered in shade but rendered faster to milling by after-chroming. Used instead of Aniline Blues for silk. Light: 1.
Anthraquinone Blue SR extra pdr. and paste, (*B*) Sodium salt of 1:5-di-amino-2:6-dibromo-4:8-disulphophenyl-aminoanthraquinone. No. 1089 (861)	A blue-black powder. In alcohol: λ = 714.0, 652.5 and 598.8. H_2O: Sparingly soluble cold, more readily soluble hot with a greenish-blue colour. Alcohol: Greenish-blue solution. HCl to aqueous solution: Blue precipitate. NaOH: Greenish-blue precipitate. H_2SO_4: Dull reddish-violet solution, blue precipitate on dilution. Dyes wool and silk from an acid bath moderately level greenish-blue of good

	fastness to light, milling and acids, unaltered in shade but rendered faster to milling by after-chroming. Used particularly for dyeing loose wool and slubbing; also to a less extent for dyeing yarn and piece-goods. Light: 1.	
Benzoin Yellow (*B*) Components— Benzoin and gallic acid. No. 1090	A yellow paste; the dried paste separates from glacial acetic acid in yellowish-brown crystalline aggregates. H_2O: Insoluble. Alcohol: Readily soluble. NaOH: Cherry-red solution. H_2SO_4: Yellow solution with a strong green fluorescence. Dyes chrome-mordanted wool yellow, fast to milling but not fast to light. Not used.	
Alizarine Rubinol G 3G, 5G, GW, R (By) Sodium salt of 4-*o*-sulpho-*p*-tolylamino-1-anthra-N-methyl-pyridone. No. 1091 R = *p*-Toluidine Z, W = Sulphanilic acid 3Z = Disulphoanilic 5Z = Chloro-anilic-sulphonic acid	*Alizarine Rubinol R*— A wine-red powder. λ for R = 529.0. λ for Z W = 527.0. 3Z = 536.5; 501.5. H_2O: Sparingly soluble cold, soluble boiling with a bluish-red colour. Alcohol: Bluish-red solution. HCl to aqueous solution: Bluish-red crystalline precipitate. NaOH: bluish-red precipitate with excess. H_2SO_4: Magenta-red solution, bluish-red precipitate on dilution. Dyes wool and silk from an acid bath, or wool from a neutral bath, level bluish-red, fast to light, washing and milling, and of good fastness to acids and alkalis. *Alizarine Rubinol GW* is more soluble and yellower in shade, whilst *Alizarine Rubinol G, 3G, 5G* dye wool from an acid bath clear red, and do not stain cotton or silk effects. Used for dyeing fast pink and salmon shades on dress goods, carpets and slubbing; *Alizarine Rubinol* G, 3G, GW are used also in Vigoureux printing.	
Alizarine Geranol B (By) No. 1092 Derivative of Anthraquinone pyrimidone. For constitution see Fierz; *Dyestuffs* [1926] p. 626	A violet powder. H_2O: Reddish-violet solution. λ = 5876; 5450. Red fluorescence Alcohol: Partly soluble, with a reddish-violet colour. HCl to aqueous solution: Redder solution. NaOH: Rather bluer solution. H_2SO_4: Light brownish-red solution; orange solution, wine-red solution and then reddish-violet solution on dilution. Dyes wool from an acid bath bright reddish-violet, rendered bluer and	

	faster to milling by after-chroming; cotton and silk effects are unstained when dyed from an acetic acid bath. Unaffected by iron, but dulled by copper.	
Indanthrene Blue WB (*B*) N-Dihydro-1:2:1′:2′-anthraquinone-azine-monosulphonic acid. No. 1093 (850)	A bluish-grey powder. H_2O: Partly soluble hot, with a blue colour. Alcohol: Partly soluble hot, with a blue colour. HCl: Insoluble. NaOH: Insoluble. H_2SO_4: Dull yellow solution, blue precipitate on dilution. Dyes wool from an acid bath greenish-blue of good fastness to light and milling; the shade is unaltered in artificial light. Not used.	

ANTHRAQUINONE VAT COLOURS

No. 1094–1176

ANTHRAQUINONE VAT COLOURS

These dyes are among the most important derivatives known to modern dyestuff chemistry, and are used in steadily rising quantities. They are all reduced with hydrosulphite, giving coloured solutions, and their dyeings are in most cases unrivalled for fastness in every respect. The Anthraquinone Vat Dyes, as a rule, are only *cotton vat dyes*. They have *no affinity for wool*, and only little affinity for silk. Silk, however, is often dyed in light shades with many indanthrene dyes, especially Algol colours and Indanthrene Blue. The shades are not deep but indestructible. The Anthraquinone Vat Dyes belong to several groups of organic compounds. There are Azines (Hydroazines), Acridones and very complex compounds of high molecular weight, containing only hydrogen, carbon and oxygen (Violanthrene, Indanthrene Golden Orange, etc.).

Sirius Yellow G paste (*B*) α-β-Naphthanthraquinone. No. 1094 (758)	A greenish-yellow paste; the dried paste crystallises from glacial acetic acid in yellow prisms, M. P. 168°. H_2O: Insoluble. Alcohol: Sparingly soluble, but more soluble in acetone, glacial acetic acid and ethyl acetate, and even more soluble in chloroform, benzene, toluene and xylene; almost insoluble in petroleum spirit. NaOH and zinc dust: Reduced to an orange coloured vat dye, with no affinity for cotton, reoxidised rapidly by air, with separa-	

	tion of a greenish-yellow flocculent precipitate. Used in admixture with the usual substrata for the preparation of pure greenish-yellow lakes of good covering power, fast to water and sufficiently fast to oil, but not fast to varnish, and darkened by exposure to light (G. P. 229401). Not used as a textile colour.	
Anthraflavone G, 2R (*B*) Diphthaloylstilbene or 2:2'-dianthraquinonylethylene. No. 1095 (759)	*Anthraflavone G*— A greenish-yellow paste, or greenish-yellow powder when dry; the powder crystallises in long yellow needles, which do not melt at 430°. H_2O: Insoluble. Alcohol: Insoluble. Xylene: Insoluble. HCl: Insoluble. NaOH: Insoluble. H_2SO_4: Reddish-violet solution, yellow precipitate on dilution; 2*R*, reddish-violet solution, orange-yellow precipitate on dilution. Dyes cotton from a dark brownish-red (2R crimson) alkaline hydrosulphite vat at 40–50°, greenish-yellow of excellent fastness to washing and chlorine, but not fast to light. When used in conjunction with Indanthrene Blue (No. 1106), however, green shades of excellent fastness to light are obtained.	
Duranthrene Golden Orange Y paste, YP paste, **(BDC)** Indanthrene Golden Orange G paste, G double paste, G pdr. Pyranthrone or 9:1:2:-2':1':9-naphthadianthrone. No. 1096 (760) (B) Helindone Golden Orange IG (MLB)	An ochre-coloured paste, or orange-yellow powder; 8 parts paste = 4 parts double paste = 1 part powder. Of the vat: λ = 544.25 and 503.5. H_2O: Insoluble. Xylene: Yellow solution. Alcohol: Traces dissolve with a yellow colour and a green fluorescence. HCl: Insoluble. NaOH: Insoluble. H_2SO_4: Dull blue solution, yellowish-brown precipitate on dilution. Dyes cotton from an alkaline hydrosulphite vat at 60–65° orange, very fast to washing, light and chlorine. The cold vat is cherry-red coloured and contains dihydropyranthrone, whereas the hot vat is of a magenta-red colour and contains tetrahydropyranthrone. Light: 2. *A very important product.*	
Indanthrene Golden Orange R paste (B) Probably trichloropyranthrone. No. 1097 (761)	An orange paste or powder. H_2O: Insoluble. Xylene: Yellow solution. HCl: Insoluble. NaOH: Insoluble. H_2SO_4: Blue solution, orange precipitate on dilution.	

	Dyes cotton from a magenta alkaline hydrosulphite vat orange of good fastness to light. It has the same properties as 1096.	
Indanthrene Scarlet G (B) Probably dibromo-pyranthrone. No. 1098 (762)	A red paste, or brownish-red powder when dry. H_2O: Insoluble. Alcohol: Insoluble. HCl: Insoluble. NaOH: Insoluble. H_2SO_4: Greyish-green solution, red precipitate on dilution. Dyes cotton from a crimson alkaline hydrosulphite vat at 60° scarlet-red, of excellent fastness to light, washing and chlorine, but rather sensitive to alkalies and lime. Hard water should not be used. Used only for dyeing light shades. Light: 1–2.	
Indanthrene Dark Blue BO paste, BO pdr. (B) Formerly— **Violanthrene BS** (B) **Helindone Dark Blue 10B paste, 10B pdr.** (MLB) Violanthrone or 2:2′-Bz-1:Bz-1′-dibenzanthrone. No. 1099 (763)	A violet-black paste or powder (4 parts paste = 1 part powder); the powder crystallises from quinoline in violet needles and decomposes on heating. Of the vat: λ = 578.25, 535.6 and 500.75. H_2O: Insoluble. Xylene: Turbid red solution with a red fluorescence. Alcohol: Traces dissolve hot, with a red colour and a greenish fluorescence. HCl: Insoluble. NaOH: Insoluble. H_2SO_4: Violet-black solution, violet-black precipitate on dilution. Dyes cotton from an alkaline hydrosulphite vat at 60–65° (which is of a reddish-violet colour with a brownish-red fluorescence) dark blue of very good fastness to washing, light, acids, alkalies and chlorine (shade unchanged), but reddened by spotting with water, although the original shade returns on drying. As it is reddened somewhat by repeated severe washing, it is frequently used in conjunction with Indanthrene Blue FS (No. 1107) for fast navy blue. Not affected at all by light: 1. [1] Fuller and duller shades are obtained at 90°.	
Indanthrene Violet RZ paste, RT pdr. (B) Chlorinated violanthrone. No. 1100 (764)	A brownish-red paste with a coppery lustre, or dark powder when dry, which decomposes on heating. λ = 583.2, 539.7 and 500.0. H_2O: Insoluble. Xylene: Reddish-violet solution with a yellow fluorescence. Alcohol: Insoluble. HCl: Insoluble. NaOH: Insoluble. H_2SO_4: Turbid violet	

Note: When used in conjunction with Cibanone Black, the fastest Black for calico printing.

	solution, dark violet precipitate on dilution. Dyes cotton from an alkaline hydrosulphite vat at 60° (which is of a sky-blue colour with a brown fluorescence) violet, very fast to washing, light and chlorine, but reddened by spotting with water and rendered bluer by hot ironing. Light: 1.–2 *Indanthrene Violet RT* may be used for the estimation of aromatic hydrocarbons in petroleum spirit (benzine), as it is insoluble in pure benzine but soluble in benzene. The percentage of the latter in a sample of benzine is determined by the intensity of the colour of the solution (Formànek).
Caledon Jade Green (*SDC*) Probably, dimethoxy-dibenzanthrone. No. 1101.	A black powder. H_2O: Insoluble. Nitrobenzene: Sparingly soluble. HCl to powder: Dull greyish-green colour. NaOH: Unaltered. H_2SO_4: Reddish-violet solution, green precipitate on dilution. HNO_3: Colour discharged, but restored by treatment with acid stannous chloride. Dyes cotton from a deep blue alkaline hydrosulphite vat bright level bluish-green, fast to chlorine and acids, and of exceptional fastness to light and washing. Light: 1.
Duranthrene Green B (B) Indanthrene Green B (BDC) For treatment with hypochlorite on the fibre— Indanthrene Black B, BB pdr., BB double paste (B) In substance— Nitro-derivative of violanthrone. On the fibre— Amino-derivative of violanthrone. No. 1102 (765)	A bluish-black crystalline paste with a coppery lustre, or dark powder which decomposes on heating. λ = 589.5, 543.25 and 499.25. H_2O: Insoluble. Xylene: Reddish-violet solution with a brown fluorescence. Alcohol: Insoluble. HCl: Insoluble. NaOH: Insoluble. H_2SO_4: Violet-black solution, violet-black precipitate on dilution. Dyes cotton from an alkaline hydrosulphite vat at 60° (which is bluish-violet coloured with a red fluorescence) green of good fastness to washing, but not fast to light, converted into grey to black of excellent fastness to light, washing, chlorine, alkalies and acids, *i. e. Indanthrene Black B* (G. P. 226215) by after-treatment with hypochlorite or other oxidising agents; a full blue-black is obtained in conjunction with *Indanthrene Dark Blue* BO (No. 1099).

Indanthrene Violet R extra (B) Formerly— Violanthrene R extra (B) 2-Bz 1′:2′-Bz 1-dibenzanthrone, isodibenzanthrone or isoviolanthrone. No. 1103 (766)	A brownish-red paste with a coppery lustre, or violet-black powder. λ = 584.5, 544.0 and 504.5. H_2O: Insoluble. Xylene: Reddish-violet solution with a red fluorescence. Alcohol: Insoluble. HCl: Insoluble. NaOH: Insoluble. H_2SO_4: Dull greenish-grey solution, bright violet precipitate on dilution. Dyes cotton from an alkaline hydrosulphite vat (which is of a violet colour with a brownish-red fluorescence), violet, very fast to light and chlorine, fast to washing, but rendered bluer by ironing and reddened by spotting with water. Light: 1. One of the best Anthraquinone vat dyes. Unsuitable for machine dyeing. Used also in calico printing.	
Indanthrene Violet RR Cibanone Violet R (SCI) Helidone Violet J2R (MLB) Dichloro-iso-violanthrone or dichloro-iso-dibenzanthrone. No. 1104 (767)	A thin brownish-red paste with a coppery lustre, or dark powder which decomposes on heating; 8 parts paste = 4 parts double paste = 1 part powder. In xylene: λ = 646.6, 597.5 and 552.5. H_2O: Insoluble. Xylene: Magenta-red solution with a yellow fluorescence. Alcohol: Insoluble. HCl: Insoluble. NaOH: insoluble. H_2SO_4: Dark orange solution, violet precipitate on dilution. Dyes cotton from an alkaline hydrosulphite vat (which is of a pure sky-blue colour with a red fluorescence) at 40–50°, bright reddish-violet, very fast to washing, light and chlorine, but reddened by ironing and by spotting with water. Cotton dyed with *Indanthrene Violet RR extra* changes shade for several weeks after dyeing when exposed to air, particularly a current of air, becoming gradually redder. Light: 1. Used for machine dyeing; also in calico printing.	
Indanthrene Violet B paste, B pdr. Formerly— Indanthrene Violet B extra paste, B extra pdr. (B) Dibromo-iso-violanthrone.	A blackish paste, or blackish powder which decomposes on heating; 4 parts paste = 1 part powder. H_2O: Insoluble. Xylene: Sparingly soluble with a red colour and a faint fluorescence. HCl: Insoluble. NaOH: Insoluble. H_2SO_4: Cherry-red solution, dull violet-blue precipitate on dilution. Dyes cotton from a dark bluish-violet alkaline hydrosulphite vat at 50–60°	

No. 1105 (768)	violet of good fastness to light, chlorine and washing. Light: 1.	
Indanthrene Blue RS paste, RS double paste, RS pdr. (B) Duranthrene Blue RD extra paste, RT paste, (BDC) Cibanone Blue RS (SCI) N-Dihydro-1:2:1′:2′-anthraquinoneazine or indanthrone. No. 1106 (837)	A dark blue paste, or blackish-blue powder; 10 parts paste = 5 parts double paste = 1 part powder. H_2O: Insoluble. Alcohol: Insoluble. Xylene: Insoluble. Quinoline: Soluble to the extent of 1:500; crystallises from the solution in dark blue curved needles, which sublime with decomposition at 500°. Acetic Acid: Insoluble. HCl: Unaltered. H_2SO_4: Brown solution, blue precipitate on dilution. Dyes cotton from a dark blue alkaline hydrosulphite vat at 50–60° blue of excellent fastness to light, washing, acids and alkalies, **but not fast to chlorine;** the shade is rendered slightly redder by the first washing with soap and soda, but subsequent washings are without effect; the shade is rendered greener by hypochlorites, but the colour is restored by treatment with a dilute solution of hydrosulphite. The fastness to chlorine is improved by steaming, preferably after treatment in an alkaline bath. Light: 1. Used also in calico printing.	
Leuco-Indanthrene Blue Sodium salt of the dihydro-derivative of N-dihydro-1:2:1′:2′-anthraquinoneazine. No. 1107 (838)	Blue needles with a copper-red lustre. NaOH: Blue solution, oxidised by air to Indanthrene Blue R (No. 1106). Dyes cotton direct from an alkaline bath pure blue. Used in the manufacture of finely-divided Indanthrene Blue (No. 1106).	
Algol Blue K pdr., K Paste (By) Indanthrene Blue RK pdr., RK paste, Formerly— N-Dimethyl-1:2:1′:2′-anthraquinoneazine. No. 1108 (839)	A blue paste or powder, which decomposes on heating; 8 parts paste = 1 part powder. $\lambda = 700.5$. H_2O: Insoluble. Xylene: Sparingly soluble with a bluish-green colour. H_2SO_4: Brownish-olive solution, blue precipitate on dilution. Dyes cotton from a cold dark brown alkaline hydrosulphite vat level blue, fast to lime, washing, boiling and light, but not fast to chlorine. Light: 1. *Algol Blue K* yields a bright green in conjunction with *Algol Yellow 3G* (No. 1139).	
Indanthrene Blue 3G paste, 3G double paste, 3G pdr. (B)	A dark blue paste or powder; 10 parts paste= 5 parts double paste = 1 part powder. H_2O: Insoluble. λ = ? Alcohol: Insoluble. Xylene: Sparingly soluble with a blue colour. Glacial	

Duranthrene Blue 3GT (BDC) Possibly a hydroxy-derivative of N-dihydro-1:2:1′:2′-anthraquinone-azine. No. 1109 (840)	Acetic acid: Sparingly soluble with a blue colour. HCl: Unaltered. NaOH: Unaltered. H_2SO_4: Brownish-olive solution, blue flocculent precipitate on dilution. Dyes cotton from a blue alkaline hydrosulphite vat cold or at 50–60° bright greenish-blue, fast to washing, light and water, but rendered greener by chlorine. Light: 1. *Indanthrene Blue 3G* is the brightest brand of Indanthrene Blue. Used in machine dyeing.
Indanthrene Blue 2GS, 2GSZ (B) Possibly a hydroxy-derivative of N-dihydro-1:2:1′:2′-anthraquinoneazine (cf. No. 1109). No. 1110 (841)	A blue paste with a bronzy lustre, or reddish-blue powder. H_2O: Insoluble. Alcohol: Insoluble. HCl: insoluble. NaOH: insoluble. H_2SO_4: Dull yellowish-brown solution, blue precipitate on dilution. Dyes cotton from a blue alkaline hydrosulphite vat blue of very good fastness to washing and light. Light: 1. Used also as a body colour and as a substitute for Ultramarine (No. 1290), fast to acids and light.
Indanthrene Blue 5G paste, 5G pdr., Formerly— Algol Blue 3G paste, 3G pdr. (By) 4:4′-Dihydroxy-N-dihydro-1:2:1′:2′-anthraquinoneazine. No. 1111 (844) Identical with 1109	A dark blue paste, or blackish powder; 8 parts paste = 1 part powder. H_2O: Insoluble. Xylene: Sparingly soluble with a reddish-violet colour. HCl: Insoluble. NaOH: Insoluble. H_2SO_4: Olive-green solution, bluish-green precipitate on dilution. Dyes cotton from a reddish-blue alkaline hydrosulphite vat at 40–50° clear greenish-blue, fast to washing and light, but not so fast to chlorine as *Algol Blue C* (No. 1115) and rendered greener by alkalies, although the original colour is restored by acetic acid. Light: 1. For Properties see No. 1113.
Indanthrene Blue CE (*B*) Monochloro-N-dihydro-1:2:1′:2′-anthraquinoneazine. No. 1112.	
Duranthrene Blue GCD paste, (BDC) Indanthrene Blue CD, GCD paste, GCD, double paste, GCD pdr. (B)	A blue paste, or blue powder; 12 parts paste = 6 parts double paste = 1 part powder. H_2O: Insoluble. Alcohol: Insoluble. HCl: Insoluble. NaOH: Insoluble. H_2SO_4: Dull yellow solution, blue precipitate on dilution.

3:3′-Dichloro-N-dihydro-1:2:1′:2′-anthraquinoneazine. No 1113 (842)	Dyes cotton from a blue alkaline hydrosulphite vat at 50–60° level blue of excellent fastness to light, very fast to washing, acids and alkalies, but rendered greener by chlorine although the original shade is restored by after-treatment with hydrosulphite. Light: 1. Used also in calico printing. The most important brand.	
Indanthrene Blue BCS Duranthrene Blue CC (BDC) (B) Trichloro-N-dihydro-1:2:1′:2′-anthraquinoneazine. No. 1114	*Duranthrene Blue CC*— A blue paste, or dark blue powder with a copper-red lustre when dry. H_2O: Insoluble. Alcohol: Insoluble. Nitrobenzene: Sparingly soluble on boiling with a pure blue colour. HCl: Insoluble. NaOH: Insoluble. H_2SO_4: Dull yellowish-brown solution, blue precipitate on dilution. Dyes cotton from a blue alkaline hydrosulphite vat at 50° very clear level blue, very fast to rubbing, washing, light and chlorine (slight loss in depth of shade, but not rendered greener). This colour must not be dyed above 50°, otherwise the shade is not fast to chlorine. Light: 1.	
Indanthrene C Cibanone Blue G (SCI) Indanthrene Blue GC paste, GC double paste, GC pdr. Formerly— Algol Blue C (By) (B) 3:3′-Dibromo-N-dihydro-1:2:1′:2′-anthraquinoneazine. No. 1115 (843)	A dark blue powder, or bluish-violet paste; 10 parts paste = 5 part double paste = 1 part powder. H_2O: Insoluble. Alcohol: Insoluble. HCl: Insoluble. NaOH: Insoluble. H_2SO_4: Dull yellowish-brown solution, blue precipitate on dilution. Dyes cotton from a blue alkaline hydrosulphite vat at 50° level-blue of excellent fastness to light, very fast to washing, acids and alkalies, and rendered greener by chlorine (faster than No. 1113, however) although the original colour is restored by after-treatment with hydrosulphite. Light: 1. This colour must not be dyed above 50°, otherwise the shade is not fast to chlorine.	
Indanthrene Green BB paste, BB pdr. Formerly— Algol Green B paste, B pdr. (By) 3:3′-Dichloro-(or di-	A bluish-green paste, or blackish powder; 8 parts paste = 1 part powder. H_2O: Insoluble. Xylene: Insoluble. H_2SO_4: Green solution, bluish-green precipitate on dilution. Dyes cotton from a bluish-green alkaline hydrosulphite vat at 50–60° rather dull greenish-blue, exceptionally fast	

bromo-) 4:4′-di-amino-N-dihydro-1:2:1′:2′-anthra-quinoneazine. No. 1116 (847)	to light and of good fastness to washing, acids and ironing, but not fast to chlorine. Used also in calico printing.	
Indanthrene Dark Blue *BT* (B) Formerly— Cyananthrene O (B) Cyananthrone. No. 1117 (846)	A violet-black paste, or brownish-black powder. λ = 586.5, 540.0 and 497. H_2O: Insoluble. Alcohol: Traces dissolve with a yellow colour and a greenish fluorescence. Xylene: Bluish-red solution with a red fluorescence. HCl: Insoluble. NaOH: Insoluble. H_2SO_4: Greenish-black solution, violet-black precipitate on dilution. Dyes cotton from an alkaline hydrosulphite vat, which is coloured violet-blue with a brownish-red fluorescence, dark blue, very fast to washing, light and chlorine. No longer manufactured.	
Indanthrene Yellow G paste, G double paste, G pdr. Helindone Yellow JG Duranthrene Yellow GP paste, GX paste (BDC) (B) Formerly— Flavanthrene (B) Algol Yellow GBA (By) (MLB) **Flavanthrone.** No. 1118 (849)	A brown paste, or dark yellow powder, which crystallises in yellowish-brown needles; 8 parts paste = 4 parts double paste = 1 part powder. Of the vat: λ = 643.0, 595.0, 539.2 and 501.5. H_2O: Insoluble. Nitrobenzene: yellow solution hot, brownish-yellow needles on cooling. HCl: Insoluble. NaOH: Insoluble. H_2SO_4: Olive solution with a red fluorescence, yellow precipitate on dilution. Dyes cotton from an ultramarine-blue alkaline[1] hydrosulphite vat blue, converted by washing in the air into level golden-yellow of excellent fastness to washing, acids, alkalies and chlorine. The fastness to light in self shades is not good, as the shade turns brown rapidly, probably owing to the formation of a compound similar to Indanthrene Brown B (No. 1120), but in mixtures (dull green shades) it is free from this defect. **The fastness to light is much improved by soaping at the boil, or by steaming under pressure.** Special care is necessary during treatment with boiling alkalies, owing to the tendency to bleed or print off. Used also for machine dyeing and in calico printing.	

[1] A vat is formed also with sodium sulphide.

Indanthrene Yellow R (B) **Alizanthrene Orange (BAC)** 3:3′-Dibromoflavanthrone. No. 1119	A brown paste. H_2O: Insoluble. Alcohol: Insoluble. Nitrobenzene: yellow solution hot, brown needles on cooling. H_2SO_4: Orange solution with a green fluorescence, orange-yellow precipitate on dilution. Dyes cotton from a blue alkaline hydrosulphite vat blue, converted by washing in the air into orange-yellow, very fast to light, washing and chlorine. Light: 1. Used also in calico printing.
Indanthrene Brown B Duranthrene Brown B paste, (BDC) (B) Components— β-Aminoanthraquinone-sulphuric acid and copper powder. No. 1120 (867)	A greyish-black paste or powder. H_2O: Insoluble. Alcohol: Traces dissolve hot, with a yellowish-brown colour. HCl: Insoluble. NaOH: Insoluble. H_2SO_4: Blackish-brown solution, blackish-brown precipitate on dilution. Dyes cotton from a dull violet alkaline [1]hydrosulphite vat level greenish-brown of only moderate fastness to washing and light, and not fast to chlorine. Light: 2. Used in machine dyeing; also largely in calico printing.
Leucol Dark Green B paste (*By*) Components— α-Methylamino-anthraquinone, sulphuric acid and aluminium bronze. No. 1121 (866)	A dark blackish-green paste, or blackish powder when dry. H_2O: Insoluble. Pyridine: Dull olive solution. H_2SO_4: Violet-black solution, olive-brown precipitate on dilution. Dyes cotton from a dull reddish-violet alkaline hydrosulphite vat olive-green, not so fast to light and washing as the majority of Anthraquinone vat dyes. Light: 2.
Pyrazol Anthrone Yellow (Gr. E.) Components— Anthraquinone-1-hydrazine dehydrated; and potassium hydroxide. No. 1122	A yellowish-red powder. H_2O: Insoluble. Aniline: Reddish-yellow solution. H_2SO_4: Yellowish-red solution. Dyes cotton from a greenish-blue alkaline hydrosulphite vat blue, converted by washing and acids into golden-yellow, fast to washing, acids and chlorine. Light: 1.
Indanthrene Grey B paste, (B) Components— 1:5-Diamino-anthraquinone and potassium hydroxide.	A bluish-black paste, or blackish powder when dry. H_2O: Insoluble. Alcohol: Insoluble. HCl: Insoluble. NaOH: Insoluble. H_2SO_4: Pure brown solution, greyish-brown precipitate on dilution.

[1] A vat is formed also with sodium sulphide.

No. 1123 (848)	Dyes cotton from an olive-green alkaline hydrosulphite vat bluish-grey, very fast to washing and light, but rendered redder by chlorine although the original shade is restored by after-treatment with hydrosulphite. Light: 1–2. Unsuitable for machine dyeing. Used also in calico printing.	
Caledon Grey KT (*SDC*) No. 1124 Sulphur Dye	A brownish-black paste. H_2O: Insoluble. HCl: Unaltered. NaOH: Unaltered. H_2SO_4: Dirty olive solution, brownish-black precipitate on dilution. Dyes cotton from an olive-brown alkaline hydrosulphite vat level grey of good fastness to light, but not fast to washing or chlorine.	
Indanthrene Maroon R (B) Formerly— *Fuscanthrene B* *(B)* Components— 1:5- (or 1:8-) Diamino-anthraquinone and formaldehyde; and potassium hydroxide. No. 1125 (845)	A dark reddish-brown paste, or blackish powder when dry. H_2O: Insoluble. Alcohol: Traces dissolve hot, with a dull red colour. HCl: Partly soluble with a brown colour. NaOH: Insoluble. H_2SO_4: Greyish-brown solution, brownish-violet precipitate on dilution. Dyes cotton from a brownish-red alkaline hydrosulphite vat violet-brown of good fastness to washing and light. Unsuitable for machine dyeing. Light: 2.	
Algol Yellow WG paste, (By) Leucol Yellow G paste, (*By*) 1-Benzoylamino-anthraquinone. No. 1126 (814)	A yellow paste, or greenish-yellow crystalline powder, M. P. 254°, when dry. H_2O: Insoluble. Xylene: Yellow solution. HCl: Insoluble. NaOH: Insoluble. H_2SO_4: Yellowish-orange solution, lemon-yellow precipitate on dilution. Dyes cotton from a cold crimson alkaline hydrosulphite vat yellow of good fastness to alkalies, washing, acids, light and chlorine. Light: 2. Used also for dyeing linen and artificial silk; also for dyeing silk (G. P. 226940); also in calico printing. Scarcely used.	
Helio Fast Yellow 6 GL (By) 1-Salicylaminoanthraquinone. No. 1127	*Helio Fast Yellow 6GL*— A yellow paste, or yellow lumps which crystallise from nitrobenzene in yellow prismatic needles, M. P. 273°. H_2O: Insoluble. Pyridine: Yellow solution. NaOH: Insoluble, coloured brown on boiling. H_2SO_4: Orange-red solution, yellow precipitate on dilution. Dyes cotton from a yellowish-red alkaline hydrosulphite vat pure greenish-yellow.	

	Helio Fast Yellow RL— An orange powder, which crystallises from nitrobenzene in orange plates, M. P. 306°. NaOH: Insoluble. H_2SO_4: Reddish-brown solution, orange precipitate in dilution. Used, in admixture with suitable substrata, for the manufacture of greenish-yellow pigments, very fast to light and water, fast to spirit and oil, and of good resistance to heat. Light: 1.	
Algol Pink R paste, R pdr. **(By)** 1-Benzoylamine-4-hydroxy-anthraquinone. No. 1128 (818)	A pink paste, or bluish-red powder. $\lambda = 577.0, 534.5$ and 489.5. H_2O: Insoluble. Xylene: Yellowish-red solution. HCl: Insoluble. NaOH: Insoluble. H_2SO_4: Red solution, bright bluish-pink precipitate on dilution. Dyes cotton from a cold yellowish-red alkaline hydrosulphite vat, bright bluish-pink, of only moderate fastness to light and soap, and not fast to boiling. Light: 2–3.	
Algol Scarlet G paste, G pdr. **(By)** 1-Benzoylamino-4-methoxy-anthraquinone. No. 1129 (815)	A reddish-orange paste, or scarlet-red powder, which decomposes on heating, with evolution of red vapours. H_2O: Insoluble. Xylene: Yellow solution. HCl: Insoluble. NaOH: Insoluble. H_2SO_4: Brownish-red solution, orange-red precipitate on dilution. Dyes cotton from a cold yellowish-red alkaline hydrosulphite vat level scarlet-red, very fast to light, and of good fastness to chlorine, acids, alkalies and boiling, but not very fast to washing. Light: 1. Used also in calico printing; also for dyeing silk (G. P. 226940) and artificial silk red, fast to light and water.	
Algol Violet B paste B pdr. (By) 1-Benzoylamino-4:5:8-trihydroxy-anthraquinone. No. 1130 (823)	A dark bluish-violet paste, or dark bluish-violet powder. H_2O: Insoluble. Xylene: Magenta-red solution. HCl: Insoluble. NaOH: Insoluble. H_2SO_4: Pure blue solution, reddish-violet precipitate on dilution. Dyes cotton from a cold brownish-red alkaline hydrosulphite vat clear violet, fast to washing, light and chlorine. Light: 1–2. Used also for dyeing silk and in calico printing. Discharged white by hydrosulphite in presence of Leucotrope on cotton.	

Algol Red 5G pdr., 5G paste, Indanthrene Red 5GK pdr., 5GK paste, Duranthrene Red 5G paste, (BDC) Formerly— (By) 1:4-Dibenzoyldiamino-anthraquinone. No. 1131 (816)	A red paste or powder; 8 parts paste = 1 part powder. λ = 571.5, 528.0 and 491.0. H_2O: Insoluble. Xylene: Yellowish-red solution. HCl: Insoluble. NaOH: Insoluble. H_2SO_4: Ponceau red solution, magenta-red precipitate on dilution. Dyes cotton from a cold violet alkaline hydrosulphite vat level reddish-scarlet of excellent fastness to light, washing and chlorine. Light: 1. Used also for dyeing silk (G. P. 226940).	
Indanthrene Yellow GK pdr. Formerly— Algol Yellow R pdr., R paste, (By) 1:5-Dibenzoyldiaminoanthraquinone. No. 1132 (817)	A yellow paste, or reddish-yellow powder, which separates from nitrobenzene in yellow crystals, M. P. above 350°. H_2O: Insoluble. Xylene: Yellow solution. HCl: Insoluble. NaOH: Insoluble. H_2SO_4: Brownish-yellow solution, orange-yellow precipitate on dilution. Dyes cotton from a cold reddish-violet alkaline hydrosulphite vat golden-yellow, exceptionally fast to light. Used also in calico printing; also for dyeing wool (G. P. 226940); also for the manufacture of pigments with the usual substrata (G. P. 233073). The best yellow of the Algol series.	
Algol Brilliant Red 2B paste (By) Algol Red FF, R extra paste, (By) (By) 1:5-Dibenzoyldiamino-8-hydroxy-anthraquinone. No. 1133 (819)	*Algol Red R extra*— A bluish-red paste, or red powder when dry. H_2O: Insoluble. λ = 560.2, 521.4 and 488.4. Xylene: Yellowish-red solution. HCl: Insoluble. NaOH: Insoluble. H_2SO_4: Red solution with green dichroism (violet solution in thin layers), crimson precipitate on dilution. Dyes: Cotton from a cold brownish-red alkaline hydrosulphite vat red, fast to washing and light. *Algol Brilliant Red 2B paste*— A dark bluish-red paste. H_2SO_4: Crimson-solution (violet in thin layers), crimson precipitate on dilution. Dyes cotton from a cold reddish-brown alkaline hydrosulphite vat clear red. Used in conjunction with Algol Brilliant Orange FR paste (No. 1136) as a substitute for Turkey Red; also for dyeing silk; also calico printing. Discharged white by hydrosulphites in presence of Leucotrope on cotton. Light: 1–2.	

Indanthrene Brilliant Violet BBK paste, BBK pdr. Formerly— Algol Brilliant Violet 2B paste, 2B pdr. (By) 4:8-Dibenzoyldiamino-1:5-dihydroxyanthraquinone. No. 1134 (821)	A dark violet paste or powder; 8 parts paste = 1 part powder. λ = 603, 559 and 519. H_2O: Insoluble. Xylene: Reddish-violet solution with a faint brownish-red fluorescence. H_2SO_4: Reddish-brown solution at first, green solution and then yellow solution on heating; violet precipitate on dilution. Dyes cotton, linen and silk from a reddish brown alkaline hydrosulphite vat cold or at 40–50°, violet. Level-dyeing: Very good. Light: 1. Used for dyeing delicate lilac and bluish-violet shades of good fastness to light, alone or in conjunction with Algol Red; also in calico printing; also for the manufacture of lakes in admixture with the usual substrata.
Algol Brilliant Violet R paste, R pdr. (By) Indanthrene Brilliant Violet RK paste, RK pdr. Duranthrene Brilliant Violet R paste, R pdr. (BDC) Formerly— 4:8-Dianisoyldiamino-1:5-dihydroxyanthraquinone. No. 1135 (820)	A violet crystalline paste, or dark violet powder; 8 parts paste = 1 part powder. H_2O: Insoluble. Xylene: Reddish-violet solution. Pyridine: Violet solution with brownish-red dichroism. H_2SO_4: Brownish-red solution which rapidly changes to green and later to yellowish-green; violet flocculent precipitate on dilution. H_2SO_4 and B_2O_3: Bright bluish-green solution which changes to blue on keeping. Dyes cotton, linen and silk from a brownish-red alkaline hydrosulphite vat cold or at 60°C. very level violet. Light: 1–2. Used also in calico printing. Discharged white by hydrosulphite in presence of Leucotrope on cotton.
Algol Brilliant Orange FR paste, FR pdr. Indanthrene Orange RRK paste, RRK pdr. Formerly— (By) 1:2:4-Tribenzoyltriaminoanthraquinone. No. 1136 (822)	An orange-red paste or powder; 8 parts paste = 1 part powder. H_2O: Insoluble. Xylene: Yellowish-orange solution. Pyridine: Yellowish-orange solution. H_2SO_4: Scarlet solution, orange-red flocculent precipitate on dilution. Dyes cotton, linen and silk from a cold reddish-orange alkaline hydrosulphite vat bright orange. Light: 1–2. Used also in calico printing. Discharged white by hydrosulphite in presence of Leucotrope on cotton.

Indanthrene Orange 6RTK paste, 6RTK pdr. Formerly— Algol Orange R paste, R pdr. (By) 1:2′-Dianthraquinonyl-amine. No. 1137 (824)	A brownish-red paste, or brown powder; 8 parts paste = 1 part powder. $\lambda = 678$. H_2O: Insoluble. Xylene: Sparingly soluble with a yellow colour. H_2SO_4: Bluish-green solution orange-red precipitate on dilution. Dyes cotton from a cold red alkaline hydrosulphite vat level brownish-orange, fast to washing, light, chlorine, acids and alkalies. Light: 1–2. Used in conjunction with Algol Red B (No. 1155) for Turkey Red shades.	
Helindone Yellow 3NG (MLB) 2:2′-Dianthraquinonyl-urea. No. 1138 (810)	A yellow paste, or yellow powder when dry. H_2O: Insoluble. Xylene: Insoluble. HCl: Insoluble. NaOH: Insoluble. H_2SO_4: Yellowish-red solution, yellow precipitate on dilution. Dyes cotton from an orange-brown alkaline hydrosulphite vat fast brilliant yellow although not exceptionally fast to light. Light: 1–2. Used for machine dyeing; also in calico printing.	
Algol Yellow 3G paste (By) 1:1′-Succinylamino-anthraquinone. No. 1139 (811)	A yellow paste, or yellow powder when dry. H_2O: Insoluble. Xylene: Yellow solution. HCl: Insoluble. NaOH: Insoluble. H_2SO_4: Yellow solution, yellow flocculent precipitate on dilution. Dyes cotton from a cold yellowish-red alkaline hydrosulphite vat fast yellow although not exceptionally fast to light. Light: 1–2. Used also in calico printing for bright green shades; also for dyeing silk. (G. P. 226940).	
Indanthrene Red G paste, G pdr. (B) 2:6-Di-anthraquinonyldiamino-anthraquinone. No. 1140 (826)	A brownish-red paste, or blackish-brown powder. $\lambda = 641.0, 587.0, 543.2$ and 497.7. H_2O: Insoluble. Xylene: Very sparingly soluble with a yellowish-brown colour. Alcohol: Insoluble. HCl: Insoluble. NaOH: Insoluble. H_2SO_4: Bluish-green solution, scarlet precipitate on dilution. Dyes cotton from a dark orange alkaline hydrosulphite vat red, fast to washing, light and chlorine. Light: 1.	
Algol Bordeaux 3B paste, B pdr. (By)	A dark brownish-red paste, or brown powder. $\lambda = 608.5$ and 558.5. H_2O: Insoluble.	

4′:4″-Dimethoxy-2:6-di-α-anthraquinonyldiaminoanthraquinone. No. 1141 (829)	Xylene: Red solution. HCl: Insoluble. NaOH: Insoluble. H_2SO_4: Bluish-green solution, magenta-red precipitate on dilution. Dyes cotton, linen, silk and artificial silk from a cold brownish-red alkaline hydrosulphite vat Bordeaux-red, fast to washing, light and chlorine. Light: 1.
Indanthrene Red R paste, R pdr. (B) 2:7-Di-α-anthraquinonyldiaminoanthraquinone. No. 1142 (830)	A brownish-red paste, or brown powder. H_2O: Insoluble. Alcohol: Insoluble. HCl: Insoluble. NaOH: Insoluble. H_2SO_4: Dark green solution, dull bluish-red precipitate on dilution. Dyes cotton from an orange-red alkaline hydrosulphite vat red, very fast to light and chlorine, and of good fastness to washing. Light: 1.
Indanthrene Bordeaux B extra (B) Anthra Bordeaux R (B) 6′:6″-Dichloro-2:7-di-α-anthraquinonyl-diaminoanthraquinone. No. 1143 (827)	*A brownish-red powder.* H_2O: Insoluble. Alcohol: Scarcely soluble. Xylene: Rather more soluble than in alcohol, with a red colour. HCl: Insoluble. NaOH: Insoluble. H_2SO_4: Greenish-blue solution, crimson precipitate on dilution. Dyes cotton from a yellowish-red alkaline hydrosulphite vat Bordeaux red, fast to washing, light and chlorine. Light: 1. *Indanthrene Bordeaux B extra* (B) is unsuitable for machine dyeing unless treated afterwards with sodium peroxide.
Indanthrene Corinth RK paste, RK pdr. Formerly— Algol Corinth R paste, R pdr. (By) Dibenzoyldiamino-1:5-di-α-anthraquinonyldiamino-anthraquinone. No. 1144 (870)	A dark paste, or violet-black powder; 8 parts paste = 1 part powder. H_2O: Insoluble. Xylene: Red solution. Pyridine: Reddish-violet solution. H_2SO_4: Greenish-olive solution, reddish-violet precipitate on dilution. Dyes cotton, linen and silk from a cold reddish-brown alkaline hydrosulphite vat lilac or heliotrope of excellent fastness to washing, light and chlorine. Light: 1–2. Used also in calico printing.
Indanthrene Grey K paste, K pdr., GK paste, GK pdr. Formerly— **Algol Grey B paste, B pdr., 2B paste, 2B pdr.** (By) Components:	*Algol Grey B*— A black paste, or blackish powder; 8 parts paste = 1 part powder. H_2O: Insoluble. Xylene: Sparingly soluble, with a violet colour. HCl: Insoluble. NaOH: Insoluble. H_2SO_4: Yellowish-green solution, grey precipitate on dilution.

1:5-Diamino-anthraquinone mixed with α-Chloro-anthraquinone and nitrate, and reduced. No. 1145 (834)	Dyes cotton from a cold reddish-brown alkaline hydrosulphite vat grey, fast to washing, light and chlorine. Light: 1. *Algol Grey* 2B— Slate-black paste, or blackish powder. H_2SO_4: Pure brown solution, brown precipitate on dilution.
Indanthrene Bordeaux B paste, B pdr. (B) 1 : 5 - Di-β-anthraquinonyldiamino-anthraquinone. No. 1146 (828)	A dull Bordeaux-red paste, or blackish-brown powder. λ = 657.0 (not distinct). H_2O: Insoluble. Alcohol: Traces dissolve hot, with a red colour. Xylene: Insoluble. HCl: Insoluble. NaOH: Insoluble. H_2SO_4: Yellowish-green solution; dull Bordeaux-red precipitate on dilution. Dyes cotton from a yellowish-red alkaline hydrosulphite vat Bordeaux-red, very fast to washing, light, acids, alkalies and chlorine. Unsuitable for machine dyeing. Light: 1.
Helindone Orange GRN (MLB) 2-Amino-anthraquinone + $COCl_2$ + Na acetate. **The nature of the condensation is little understood. Similar products are obtained from the isocyanates and from the dianthraquinonylureas.** No. 1147 (835)	An orange-brown paste, or brownish-red powder when dry. H_2O: Insoluble. H_2SO_4: Green solution, yellowish-red precipitate on dilution. Dyes cotton from a cold brownish-red alkaline hydrosulphite vat orange. Level-dyeing, very good; reduced readily; solubility of leuco-compound very good. Light: 1–2. Used in machine dyeing and in calico printing. Discharged white in the case of pale shades.
Helindone Brown 3GN paste (**MLB**) Condensation of Tolyanthraquinone-amines with $AlCl_3$ with access of air. (Baking-Process). No. 1148 (836)	A brown paste, or brown powder when dry. H_2O: Insoluble. H_2SO_4: Yellowish-brown solution, yellowish-brown precipitate on dilution. Dyes cotton from a reddish-brown alkaline hydrosulphite vat brown. Light: 1. Level-dyeing, good; reduced readily; solubility of leuco-compound very good. Used also in calico printing.
Indanthrene Brown GR paste, GR pdr. Formerly— Helindone Brown	A dark brown paste, or dark brown powder; 5 parts paste = 1 part powder. H_2O: Insoluble. Xylene: Insoluble. H_2SO_4: Brown solution, brown precipitate on dilution.

AN paste, AN pdr. (MLB) See 1148. No. 1149 (873)	Dyes cotton from a yellowish-brown alkaline hydrosulphite vat brown. Light: 1. Level-dyeing, very good; reduced readily. Used also for machine dyeing and in direct printing.	
Indanthrene Olive R paste, R pdr. Formerly— Algol Olive R paste, R pdr. (By) Duranthrene Olive R paste, (BDC) Components— 1-Benzoylamino-4-chloroanthraquinone and 1-Benzoylamino-4-aminoanthraquinone; and chlorosulphonic acid. No. 1150 (833)	A dark greenish-brown paste, or grey powder; 8 parts paste = 1 part powder. H_2O: Insoluble. Xylene: Insoluble. Pyridine: Sparingly soluble, with a green colour. HCl: Insoluble. NaOH: Insoluble. H_2SO_4: Red solution, flocculent olive-green precipitate on dilution. Dyes cotton, linen and silk from an orange-brown alkaline hydrosulphite vat cold or at 60° olive. Light: 1–2. Level-dyeing very good. Used also in calico printing. Discharged white by hydrosulphite in presence of Leucotrope on cotton.	
Indanthrene Brown R paste, R pdr. Formerly— Algol Brown R paste, R pdr. (*By*) Components— 1-Benzoylamino-5-chloroanthraquinnone and 1-Benzoylamino-4-amino-anthraquinone; and sulphuric acid. No. 1151	A reddish-brown paste or powder; 8 parts paste = 1 part powder. H_2O: Insoluble. Xylene: Sparingly soluble, with a reddish-brown colour. HCl: unaltered. NaOH: Unaltered. H_2SO_4: Dull wine-red solution, reddish-brown flocculent precipitate on dilution. Dyes cotton, linen and silk from a dark purplish-brown alkaline hydrosulphite vat cold, or at 60°, reddish-brown of excellent fastness to washing, light, chlorine (slight loss in depth) and acids. Light: 1. Used also in calico printing.	
Indanthrene Brown G paste, G pdr. Formerly— Algol Brown G paste, G pdr. (By) See 1148 No. 1152	A dark olive-brown paste, or dark brownish-black powder; 8 parts paste = 1 part powder. H_2O: Insoluble. HCl: Unaltered. NaOH: Unaltered. H_2SO_4: Deep crimson[1] solution, pure brown precipitate on dilution. Dyes cotton from an orange-brown alkaline hydrosulphite vat cold, or at 60° brown, very fast to washing, light, chlorine and acids.	
Caledon Brown KT (*SDC*) No. 1153 Sulphur Dye	A dark brown paste. H_2O: Insoluble. HCl: Unaltered. NaOH: Unaltered. H_2SO_4: Dark brown solution, dark brown precipitate on dilution.	

[1] *Caledon Brown G* (*SDC*), however, dissolves in sulphuric acid, with an olive-brown colour and forms a brown vat.

	Dyes cotton and wool from a greenish-black hydrosulphite vat brown, moderately fast to light and washing, but not to chlorine. Light: 2–3.	
Leucol Brown B paste (*By*) Components— Anthranol (or anthraquinone and copper powder) and sulphuric acid. No. 1154 (872)	A blackish paste, or dark brown powder when dry. H_2O: Insoluble. Xylene: Insoluble. H_2SO_4: Greyish-brown solution, brown precipitate on dilution. Dyes cotton from a brownish-violet alkaline hydrosulphite vat brown, fast to light, washing and ironing, but not fast to chlorine. Light: 2–3.	
Algol Red B paste, (**By**) 4:2′-Anthraquinonylamino-N-methylanthrapyridone. No. 1155 (825)	A dark bluish-red paste, or brown powder when dry. λ = 524.8, 490.5 and 457.8. H_2O: Insoluble. Xylene: Red solution. HCl: Insoluble. NaOH: Insoluble. H_2SO_4: Reddish-violet solution, red precipitate on dilution. Dyes cotton from a yellowish-red cold alkaline hydrosulphite vat moderately bright pink to bluish-red, fast to washing, light, acids, alkalies and chlorine, rendered rather yellower by soaping when boiled. Light: 1. The first red vat dye of the anthraquinone series and the only one that is *Red*. The others are more yellow or blue. Used for dyeing cotton yarn and piece-goods.	
Indanthrene Copper R (*B*) Possibly an anthrapyridone derivative. No. 1156 (813)	A reddish-brown paste, or reddish-brown powder when dry. H_2O: Insoluble. Alcohol: Insoluble. HCl: The colour of the paste changes to yellowish-brown. NaOH: Insoluble. H_2SO_4: Orange-brown solution, brownish-yellow precipitate on dilution. Dyes cotton from a reddish-brown alkaline hydrosulphite vat reddish-brown, fast to washing and chlorine, and of good fastness to light. Light: 1–2. Used also in machine dyeing.	
Indanthrene Orange RT paste. (*B*) Possibly an anthrapyridone derivative. No. 1157 (812)	A brown paste, or orange-red powder when dry. H_2O: Insoluble. Alcohol: traces dissolve hot, with a brownish-yellow colour. HCl: The colour of the paste changes to yellowish-brown. NaOH: Insoluble. H_2SO_4: Dark brown solution, yellowish-brown precipitate on dilution.	

	Dyes cotton from a brownish-orange alkaline hydrosulphite vat at 60° orange, fast to chlorine and washing, and of good fastness to light, alkalies and acids. Light: 1–2. Used also in machine dyeing.	
Aceanthrene Green Components— Aceanthrene-quinone and hydroxylamine hydrochloride dehydrated; and potassium hydroxide. No. 1158	A green powder. H_2O: Insoluble. Dyes cotton from a cherry-red alkaline hydrosulphite vat violet-red, converted by washing in the air into fast emerald-green. Not manufactured.	
Hydron Yellow G 20% paste, (C) N-Ethyl-2:3:2′:3′-dianthra-quinonecarbazole or 2:3:2′:3′-diphthalyl-N-ethylcarbazole. No. 1159	A dull orange-yellow paste. H_2O: Insoluble. H_2SO_4: Reddish-violet solution. Dyes cotton from a brown alkaline hydrosulphite vat yellow, very fast to washing, chlorine, alkalies and acids, and exceptionally fast to light. Light: 1.	
Erweco Yellow (*RW*) 1:2:1′:2′-Dianthraquinnone-oxene or diphthalyldiphenylene dioxide. No. 1160	A yellow paste. H_2O: Insoluble. Nitrobenzene: Soluble. Acetic Acid: Soluble. HCl: Unaltered. NaOH: Unaltered. H_2SO_4: Yellowish-red solution, yellow precipitate on dilution. Dyes cotton from a brownish-red alkaline hydrosulphite vat pure yellow of excellent fastness. Light: 1.	
Indanthrene Red-Violet RRK paste, RRK pdr. Duranthrene Red Violet 2RN paste, (BDC) Formerly— Indanthrene Red-Violet RRN paste, RRN pdr. (B) 3′:4′-Dichloro-1:2-anthraquinone-acridone. No. 1161 (871)	A dark violet paste, or dark violet powder, which evolves brown vapours on heating; 8 parts paste = 1 part powder. H_2O: Insoluble. Xylene: Bluish-red solution. H_2SO_4: orange solution, reddish-violet flocculent precipitate on dilution. Dyes cotton from a cold reddish-violet alkaline hydrosulphite vat level reddish-violet developed fully by a boiling soap bath. Light: 1. *Indanthrene Red-Violet* is the best vat dye available for pink shades. Used also in machine dyeing.	
Indanthrene Red RK paste, RK pdr. Duranthrene Red	A brick-red paste, or powder which sublimes with brown vapours on heating; 8 parts paste = 1 part powder. H_2O: Insoluble.	

BN paste (BDC) 1:2-Anthraquinone-naphthacridone. No. 1162 (831)	Xylene: Sparingly soluble with a light red colour. Pyridine: Sparingly soluble with a light red colour. HCl: Insoluble. NaOH: Insoluble. H_2SO_4: Orange-yellow solution, flocculent reddish precipitate on dilution. Dyes cotton from a Bordeaux-red alkaline hydrosulphite vat, at a temperature not exceeding 30°, red of excellent fastness to rubbing, light, washing, and chlorine. The colour tends to bleed during kier boiling. Light: 1. Used in machine dyeing; also in calico printing, particularly for pale shades. Discharged white by hydrosulphite in presence of Leucotrope on cotton.
Indanthrene Violet RN extra paste (B) 1:2:5:6-Anthraquinone-diacridone. No. 1163 (832)	A bright violet paste, or blackish powder (4 parts paste = 1 part powder); the latter sublimes partially with brown vapours on heating and crystallises from nitrobenzene in bluish-violet metallic needles. H_2O: Insoluble. Xylene: Sparingly soluble with a reddish-violet colour. HCl: Insoluble. NaOH: Insoluble. H_2SO_4: Dull green solution, flocculent violet precipitate on dilution. Dyes cotton from a dark violet-blue alkaline hydrosulphite vat, at 40–50°, violet, fast to ironing and water, of excellent fastness to rubbing, light and chlorine, and not reddened by water spots, but only moderately fast to washing and boiling. Light: 1. Used in machine dyeing; also in calico printing.
Indanthrene Golden Orange GN (B) 3′:4′-Dichloro-1:2-anthraquinone-thioxanthone. No. 1164	An orange-yellow paste, or orange-yellow powder when dry. H_2O: Insoluble. Dyes cotton from a violet alkaline hydrosulphite vat fast orange-yellow. Light: 1. Used in calico printing for yellow shades as it is applied more readily than Indanthrene Yellow.
Indanthrene Yellow GN extra paste, (B) 2′:5′-Dichloro-1:2-anthraquinone-thioxanthone. **No. 1165**	A yellow paste, or yellow powder when dry. H_2O: Insoluble. H_2SO_4: Pure brown solution, orange precipitate on dilution. Dyes cotton from a cold violet alkaline hydrosulphite vat level golden-yellow, very fast to washing, light, chlorine and water, and of good fastness to acids, alkalies, rubbing, ironing and steaming. Light: 1.

	Used also in machine dyeing and in calico printing.	
Algol Brown B paste (*By*) Components— Anthraquinone sulphonic acids, sodium sulphide and sulphur. No. 1166 (869)	A blackish-brown paste, or blackish powder when dry. H_2O: Insoluble. Xylene: Insoluble. Pyridine: Insoluble. H_2SO_4: Olive-brown solution, brown precipitate on dilution. Dyes cotton from a violet-brown alkaline hydrosulphite vat cold or at 60°, yellowish-brown. Light: 2. Not fast to chlorine. Used also for dyeing linen and silk.	
Indanthrene Olive G paste and pdr. (B) Duranthrene Olive GL pdr. (BDC) Components— Anthracene and sulphur. No. 1167 (791)	A dull olive-brown paste, or black powder. H_2O: Insoluble. Xylene: Insoluble. Acetic Acid: Insoluble. Alcohol: Insoluble. HCl: Insoluble. NaOH: Insoluble. H_2SO_4: Black-brown solution, brownish-black precipitate on dilution. Dyes cotton, from a dull bluish-green alkaline hydrosulphite vat at 60°, olive of good fastness to washing and light, but not fast to chlorine. Light: 2–1.	
Hydron Olive B pdr., G paste. (*C*) No. 1168 Identical with 1167	*Hydron Olive*— A black powder. H_2SO_4: Orange-brown solution, pure brown precipitate on dilution. Dyes cotton, from a dull Bordeaux-red (B), or dull violet-blue (G) alkaline hydrosulphite vat, olive shades of excellent fastness to washing, light and acids.	
Cibanone Orange R paste and pdr. (SCI) Components— 2-Methylanthraquinone (or its chloro-derivatives) and sulphur; and sodium hypochlorite. No. 1169 (792)	A bright orange paste, or reddish-brown powder. H_2O: Insoluble. Xylene: Insoluble. HCl: Insoluble. NaOH: Insoluble. H_2SO_4: Claret-red solution, orange precipitate on dilution. Dyes cotton from a reddish-brown alkaline hydrosulphite vat bright orange of good fastness to washing, light and chlorine. Light: 1.	
Cibanone Yellow R paste, (SCI) Components— 3-Chloro-2-methyl-anthraquinone (or its chloro-derivatives) and sulphur; and	A yellow paste, or yellow powder when dry. λ = 530.6 and 492.6. H_2O: Insoluble. Xylene: Sparingly soluble with a yellow colour. Alcohol: Insoluble. HCl: Insoluble. NaOH: Insoluble. H_2SO_4: Dull reddish-violet solution, yellow precipitate on dilution.	

sodium hypochlorite. No. 1170 (795)	Dyes cotton and artificial silk from a brown alkaline hydrosulphite vat level pure yellow, very fast to ironing, rubbing, washing, alkalies and chlorine, and fast to light, although not exceptionally so. Light: 2–1. Used in machine dyeing; also for bright green shades.	
Cibanone Brown B, V (**SCI**) Components— 1-Amino-2-methyl-anthraquinone and sulphur. No. 1171 (868)	*Cibanone Brown B*— A brownish-black powder. H_2SO_4: Reddish-brown solution, brown precipitate on dilution. Dyes cotton from a yellowish-brown alkaline hydrosulphite vat level brown, moderately fast to light and washing, but not fast to chlorine. Light: 2–1. Cannot be discharged satisfactorily by any of the usual reagents.	
Cibanone Black B, (**SCI**) Components— 2-Methylbenzanthrone and sulphur. No. 1172 (794)	A black paste, or black powder when dry. H_2O: Insoluble. Xylene: Insoluble. Pyridine: Sparingly soluble with a violet colour and a brownish-red fluorescence. H_2SO_4: dull claret-red solution, bluish-black flocculent precipitate on dilution. Dyes cotton from an alkaline hydrosulphite vat at 60°, (which is coloured blackish-violet with a brownish-red fluorescence), black of very good fastness to washing, light, chlorine and acids. **The best black for printing.** See Indanthrene Black B.	
Cibanone Blue 3G (**SCI**) Components— 2-Methylbenzanthrone, sulphur and naphthalene. No. 1173 (793)	A bluish-green paste, or coppery powder with a greenish-cast when dry. H_2O: Insoluble. Alcohol: Insoluble. Xylene: Insoluble. Pyridine: Insoluble. H_2SO_4: Brownish-red solution, greenish flocculent precipitate on dilution. Dyes cotton from a dark bluish-violet alkaline hydrosulphite vat greenish-blue fast to light and washing, and sufficiently fast to chlorine for most purposes. Light: 1. Used also in calico printing.	
Cibanone Green B paste and pdr. (SCI) Components— Cibanone Blue 3G (No. 1173) Oxidised. No. 1174	*Cibanone Green B*— A bottle-green paste or powder. H_2O: Insoluble. Nitrobenzene: Sparingly soluble, with a green colour on boiling. H_2SO_4: Brown[1] solution, bluish-green precipitate on dilution. Dyes cotton, from a violet alkaline hydrosulphite vat at 60°, green, sufficiently fast to chlorine for most	

[1] *Cibanone Green G* dissolves in sulphuric acid with a claret-red colour, and forms a pure brown vat.

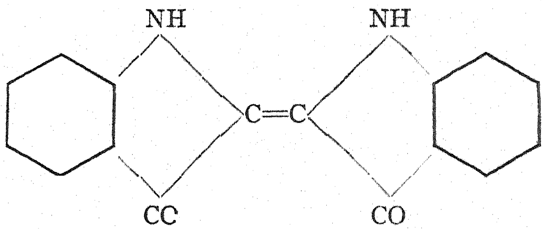
	purposes and of good fastness to other agencies. Used also in calico printing.	
Cibanone Olive B paste and pdr. (*SCI*) Component— Cibanone Blue 3G (No. 1173), oxidised. No. 1175	*Cibanone Olive B*— A dark green paste, or brownish-black powder. H_2O: Insoluble. Nitrobenzene: Sparingly soluble with a brown colour on boiling. H_2SO_4: reddish-brown[1] solution, brown precipitate on dilution. Dyes cotton, from a greenish-blue alkaline hydrosulphite vat at 60°, olive of excellent fastness; the shade is altered by chlorine, but is restored by treatment with hydrogen sulphide. Light: 1.	
Helindone Brown CM paste, CR paste (MLB) Helindone Yellow CG paste, CG vat (MLB) Components— A diarylidochloroquinone and sodium sulphide. No. 1176 **Not an anthraquinone compound.**	*Helindone Brown CR*— An olive-brown paste. H_2SO_4: Dull bottle-green solution, greenish-brown precipitate on dilution. Dyes wool and cotton from a brownish-yellow hydrosulphite vat brown, fast to washing, light, milling and carbonising. Used for dyeing wool; also in calico printing. Discharged white on cotton. *Helindone Yellow CG vat*— A brown incomplete solution, rapidly oxidised by air. HCl: Greenish-brown precipitate and evolution of sulphur dioxide. NaOH: Brown precipitate. H_2SO_4 (dry powder): Violet solution; red solution and then brown precipitate on dilution. Dyes cotton from a clear pale yellow hydrosulphite vat brownish-yellow of very good fastness. Light: 1–2. Used also in calico printing.	

[1] *Cibanone Olive G* dissolves in sulphuric acid with a dull claret colour, and forms a pure brown vat.

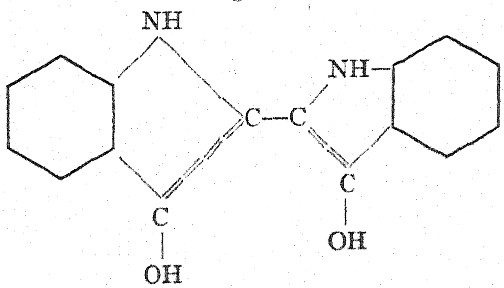
INDIGOID COLOURING MATTERS

The group of Indigo and its derivatives has become one of the most important classes of artificial dyestuffs, and the shades obtained range from yellow to green, blue, violet, red and orange. Natural Indigo has practically disappeared from the market, and the "king of dyestuffs" is manufactured in large quantities in Germany, France, England, America and Switzerland. The product on the market is almost chemically pure. The quantitative estimation will be found under "Analysis of Colouring Matters." (See also Arthur Green, *Analysis of Dyestuffs*, London, 1921.) The best method consists in sulphonating (di- or tetra-) the dye and oxidising the soluble derivative with potassium permanganate. Indigo and Indigoid dyestuffs may be *extracted from the fibre* with *pyridine;* also with glacial acetic acid.

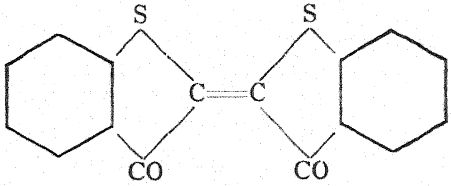
Indigo



"*Indigo-White*"



On replacing the NH-group in Indigo by sulphur (S) there is formed Friedlaender's **Thio-indigo:**



Indigo (Synthetic) Indigo LL paste and pdr., LLP paste for printing, LL, 20% paste, NAC 20% paste, NAC pdr. (BDC) (Lev) (DuP) (NAC) Indigo Ciba, paste 20% CNMC, synthetic pdr. CNMC, Pure NSK, BASF/S paste, Pure BASF 20% paste, Pure BASF pdr./L MLB/O E, MLB 20% paste, MLB pdr. (Gy) (MDW) (MLB) (Rn) (VH) (SCI) (CN) (CN) (JDC) (B) (MLB) Indigotin or 2:2′-bisindole-indigo. No. 1177 (874)	A reddish-blue 20% paste, or dark blue powder, rendered copper-coloured by friction and subliming on heating in reddish-violet vapours, which condense to a sublimate of dark violet glistening needles. H_2O: Insoluble. In xylene: $\lambda = 590.9$. Aniline: Violet-blue solution, hot; also soluble hot in other organic solvents of high boiling point; such as nitrobenzene, phenol, naphthalene, glacial acetic acid, melted paraffin wax, &c. Indigo crystallises, on cooling, in rhombic prisms with pronounced dichroism. HCl: Unaltered. NaOH: Unaltered when dilute; with cold concentrated sodium hydroxide an addition product, $C_{16}H_{10}N_2O_2.NaOH$, is formed, but, on heating, Indigo is decomposed. H_2SO_4: Yellowish-green solution, (a crystalline sulphate, $C_{16}H_{10}N_2O_2.H_2SO_4$, can be obtained), blue precipitate on dilution. **HNO_3 (sp. gr. 1.34). Yellow colour** due to the formation of isatin. Very characteristic, but not absolutely distinctive, because certain other H_2O dyes behave in a similar manner. Dyes wool from a warm yellow hydrosulphite or fermentation vat, and cotton from a cold hydrosulphite, ferrous sulphate and lime, zinc dust and lime or fermentation vat blue, fast to light and washing. Light: 1–2. Used largely for dyeing cotton, wool, linen and silk and as a bottom for compound (woaded) shades, such as brown, olive, black &c.; also in machine dyeing; also in printing with caustic soda on glucose-prepared calico (Schlieper and Baum process), or with reduction discharges, such as hydrosulphite in presence of Leucotrope, or with oxidation discharges, such as chromate or ferricyanide.

On introducing a halogen, such as Cl or Br, there are obtained dyestuffs which are more solid towards all reagents and have much better affinity towards all textile fibres. The most important halogen derivative is G. Engi's Ciba Blue 2B (No. 1184). The Greens are Naphthindigos; others are mixed Indigos or derivatives of Acenaphthene quinone (Ciba Green, Ciba Scarlet etc.).

Whilst the products of reduction obtained from Indigo are colourless, the leuco-derivatives of the other Indigoids have characteristic colorations.

Indigo LL Vat I, Vat II, (BDC) Indigo Ciba Solution B 20%, W 20% (SCI) Indigo MLB Vat I 20%, Vat II 20%, (MLB) Leuco-Indigotin. No. 1178 (876)	A white paste, which gradually becomes blue on exposure to air. H_2O: Insoluble. Alcohol: Soluble with a blue fluorescence. HCl to paste: Unaltered. NaOH: Yellowish-green solution (Indigo vat). Dyes cotton, wool and silk blue from an alkaline vat containing small quantities of a reducing agent. Used also in calico printing.	
Indigosol (D. H.) A new product; ester of Leuco-Indigo Indigosol (D. H.) is a sulphonic acid of Indigo white	*Indigosol DH*— A white to grey powder. H_2O: Soluble. Alcohol: Soluble. HCl to aqueous solution. Decomposed on keeping or by heating. NaOH: Unaltered. Dyes cotton padded with an aqueous solution and oxidised with a mild oxidising agent, such as ferric chloride, nitrous acid, acidified dichromate &c., blue (Indigo). The fastness is similar to that of ordinary Indigo, except that the fastness to rubbing is much superior.	
Indigo Salt T (*K*) Bisulphite compound of *o*-nitro-β-phenyl-lacto-methyl-ketone. No. 1179 (875)	Used in dyeing and printing. A colourless crystalline paste with an odour of sulphur dioxide (bisulphite compound). H_2O: Soluble, but precipitated from the solution by sulphurous acid; this precipitate redissolves on adding sodium carbonate, followed by sodium bisulphite. Dilute aqueous solutions of the bisulphite compound deposit the lactoketone at 40°, and this redissolves on the addition of sodium bisulphite. NaOH: Precipitate of Indigo. Dyes cotton from an aqueous solution and passed through a warm bath of sodium hydroxide (sp. gr. 1.16), blue (Indigo). Used also in calico printing. *Indigo Salt T* is sensitive to light and is best made immediately before use. The yield of Indigo is not good, and the alkali exerts a mercerising action on the cotton. No longer made.	
Indigo Extract L paste, pdr., paste, (BDC) (JCO) (JCO) (JWL) (YDC) Indigotine, Ia, conc., Ia pdr.	*Indigo Carmine D—blue:* A brown or reddish-brown paste; *Indigotine Ia pdr.* (*B*): A brown to reddish-brown powder. In water: $\lambda = 616.8$. H_2O: Blue solution. Alcohol: Sparingly soluble. HCl to aqueous solution; Bluish-violet solution; blue solution on dilution with water. NaOH: Green to yellowish-	

(NAC) (TMC) (Gy) (B) Sodium salt of indigotin-5:5′-disulphonic acid. No. 1180 (877)	green solution. H_2SO_4: Bluish-violet solution; blue solution on dilution. Dyes wool and silk from an acid bath bright, but rather fugitive, blue. Light: 4–5. Used only to a limited extent for dyeing wool and silk, as it has been largely replaced by Patent Blue, &c.; also for colouring foodstuffs. Officially permitted for the latter purpose in Australia and the United States.	
Indigotine P (*B*) Probably, sodium salt of indigotin-5:7:5′:7′-tetrasulphonic acid. No. 1181 (878)	Violet powder or copper-red lumps. H_2O: Readily soluble with a blue colour. Alcohol: Insoluble. HCl: Blue solution, appearing red by transmitted light on dilution with water. NaOH: Red solution; yellow solution on dilution. H_2SO_4: Blue solution; blue solution on dilution, appearing red by transmitted light. Dyes wool bluish-violet from an acid bath. Light: 4–5.	
Indigo LL2R paste, Ciba R, Ciba 2R, (BDC) (SCI) Mixtures of 5-bromo-indigotin (R brands) and 5:5′-dibromoindigotin (RR brands). No. 1182 (879)	A blue powder which sublimes in purple-red vapours on heating. H_2O: Insoluble. Alcohol: Insoluble. Xylene: Blue solution. HCl: Insoluble. NaOH: Insoluble. H_2SO_4: Dull olive-green solution, blue precipitate on dilution. Dyes cotton and wool from a golden-yellow hydrosulphite vat reddish-blue, redder than Indigo (No. 1177).	
Ciba Blue B (SCI) Indigo Pure BASF/ RB, Pure BASF/RBN (B) Helindone Blue BB paste, (MLB) Indigo MLB/2B, (MLB) Mainly 5:7:5′-tribromoindigotin, together with varying proportions of 5:5′-dibromoindigotin and 5:7:5′:7′-tetrabromoindigotin. No. 1183 (880)	A dark blue powder which evolves purple-red vapours on heating. In xylene: $\lambda = 601.6$. Of tribromoindigotin: $\lambda = 612.0$. H_2O: Insoluble. HCl: Unaltered. NaOH: Unaltered. H_2SO_4: Dull green solution, blue precipitate on dilution. Dyes cotton and wool from a golden-yellow hydrosulphite vat reddish-blue; the shade is decolorised by treatment with concentrated nitric acid. Has **excellent affinity** for animal fibres. Used also in printing. Very important.	

Ciba Blue 2B, Durindone Blue 4B paste, (BDC) 2BD, (CAC) (SCI) (SCI) Indigo KB, MLB/4B, (MLB) (K) 5:7:5′:7′-Tetrabromo-indigotin. No. 1184 (881)	A blue powder which sublimes in reddish-violet vapours on heating. In xylene: λ = 613.2. H_2O: Insoluble. Alcohol: Insoluble. HCl: Unaltered. NaOH: Unaltered. H_2SO_4: Bluish-green solution, blue precipitate on dilution. Dyes cotton, wool and silk from a golden-yellow[1] hydrosulphite vat bright blue, purer in shade and faster than Indigo (No. 1177); the shade is little affected by concentrated nitric acid. Used also in printing and machine dyeing. **The most important indigo derivative.**	
Ciba Blue G (SCI) Indigo K2B, MLB/5B (K) (MLB) 4:5:7:5′:7′-Pentabromo-indigotin, together with some 5:7:5′:7′-tetrabromoindigotin. No. 1185 (882)	A dark blue paste, or dark blue powder when dry, which sublimes in reddish-violet vapours on heating. H_2O: Insoluble. Xylene: Blue solution, which appears red by transmitted light. H_2SO_4: Greenish-blue solution, blue precipitate on dilution. Dyes cotton from a golden-yellow hydrosulphite vat blue, which appears greener by artificial light. Used also in calico printing.	
Durindone Blue 6B paste, 6B pdr. (BDC) Indigo KG, MLB/6B (K) (MLB) 4:5:7:4′:5′:7′-Hexa-bromoindigotin, together with some 4:5:7:5′:7′-penta-bromoindigotin. No. 1186 (883)	A blue powder, which sublimes in reddish-violet vapours on heating. In xylene: λ = 615.0. H_2O: Insoluble. Alcohol: Insoluble. HCl: Unaltered. NaOH: Unaltered. H_2SO_4: Blue solution, blue precipitate on dilution. Dyes cotton from a golden-yellow hydrosulphite vat greenish-blue, unaffected by concentrated nitric acid. The sodium salts of the leuco-compounds of the higher halogenated indigos are sparingly soluble. Used also in calico printing.	
Ciba Brown R paste (SCI) 5:7:5′:7′-Tetrabromo-6:6′-diamino-indigotin. No. 1187	A brown paste, or brown powder when dry. In methyl benzoate: λ = 563.3. H_2O: Insoluble. Nitrobenzene: Brownish-red solution. H_2SO_4: Reddish-blue solution, reddish-brown precipitate on dilution. Dyes cotton and wool from a yellowish-brown hydrosulphite vat chocolate-brown, fast to washing, light, milling and potting, but not fast to chlorine. Used also in calico printing. Discharged by chlorate on cotton.	

[1] A vat is formed also with sodium sulphide (G. P. 260461).

Brilliant Indigo BASF/2B (B) 5:5′-Dichloro-7:7′-dibromoindigotin. No. 1188 (884)	A blue paste, or blue powder, which sublimes in reddish-violet vapours on heating. H_2O: Insoluble. H_2SO_4: Bluish-green solution, blue flocculent precipitate on dilution. Dyes cotton from a yellow hydrosulphite vat blue. Used also in calico printing.	
Brilliant Indigo BASF/4G (B) 4:4′-Dichloro-5:5′-dibromoindigotin. No. 1189 (887)	A dark blue paste, or blue powder, which sublimes in reddish-violet vapours on heating. H_2O: Insoluble. Xylene: Blue solution. H_2SO_4: Greenish-blue solution, blue flocculent precipitate on dilution. Dyes cotton from a dark yellow[1] hydrosulphite vat which has a red bloom at first and later a blue bloom; greenish-blue, greener than other commercial derivatives of Indigo. Used also in calico printing.	
Brilliant Indigo BASF/B (B) 5:7:5′:7′-Tetrachloroindigotin. No. 1190 (885)	A blue paste, or blue powder, which sublimes in reddish-violet vapours on heating. In xylene: $\lambda = 609.0$. H_2O: Insoluble. Alcohol: Insoluble. HCl: Unaltered. NaOH: Unaltered. H_2SO_4: Bluish-green solution, blue precipitate on dilution. Dyes cotton from a yellow hydrosulphite vat bright blue, clearer and faster than Indigo; the shade is unaffected by concentrated nitric acid. Used also for dyeing wool and silk; also in calico printing.	
Brilliant Indigo BASF/G (B) 4:5:4′:5′-Tetrachloroindigotin. No. 1191 (886)	A dark blue paste, or blue powder, which sublimes in reddish-violet vapours on heating. In xylene: $\lambda = 610.0$. H_2O: Insoluble. Xylene: Blue solution. HCl: Unaltered. NaOH: Unaltered. H_2SO_4: Greenish-blue solution, blue precipitate on dilution. Dyes cotton from a dark yellow hydrosulphite vat greenish-blue; the shade is sensitive to concentrated nitric acid. Used also in calico printing.	
Methyl Indigo B (Mo.) Indigo MLB/T	A blue paste, or blue powder, which sublimes in reddish-violet vapours on heating. In xylene: $\lambda = 603.8$.	

[1] A vat is formed also with sodium sulphide (G. P. 260461).

(MLB) 7:7′-Dimethylindigotin. No. 1192 (888)	Alcohol: Somewhat soluble. Acetone: Somewhat soluble. H_2SO_4: Olive-brown solution, converted into green and then blue solution on heating. Dyes cotton and wool from a yellow hydrosulphite vat blue, greener and much faster to chlorine than Indigo (No. 1177); decolorised by concentrated nitric acid.	
Methyl Indigo R (Mo) 5:5′-Dimethylindigotin No. 1193	A blue paste or powder. Alcohol: Almost insoluble. Acetone: Almost insoluble. Dyes cotton and wool from a yellow hydrosulphite vat blue, redder than Indigo (No. 1177).	
Ciba Lake Red B (SCI) Components— Indigo (No. 1177) and phenacetyl chloride. No. 1194	A red powder which sublimes in carmine-red vapours on heating and separates from nitrobenzene in red crystals. H_2O: Insoluble. Nitrobenzene: Readily soluble hot with a carmine-red colour and a yellow fluorescence. H_2SO_4: Yellowish-orange solution with a faint yellow fluorescence, flocculent carmine-red precipitate on dilution. Ciba Lake Red B does not form a vat. Used for the manufacture of pigments.	
Indigo Yellow 3G Ciba paste (SCI) Components— Indigo (No. 1177), benzoyl chloride, nitrobenzene and copper powder. No. 1195 (889)	A greenish-yellow paste, or greenish-yellow powder when dry, which partially sublimes in yellow vapours on heating, and crystallises from nitrobenzene in yellow needles, M. P. 270–272°. H_2O: Insoluble. Xylene: Yellow solution. H_2SO_4: Brownish-red solution, greenish-yellow flocculent precipitate on dilution. Dyes cotton, wool and silk from a bluish-red hydrosulphite vat very fast yellow. Used in calico printing in conjunction with Indigo for green shades. Discharged white by hydrosulphite in presence of Leucotrope on cotton.	
Ciba Yellow G paste (SCI) Indigo Yellow G Ciba (SCI) Dibromated Indigo Yellow 3G. No. 1196 (890)	A greenish-yellow paste, or greenish-yellow powder when dry. H_2O: Insoluble. Xylene: Yellow solution. H_2SO_4: Brownish-red solution, greenish-yellow precipitate on dilution. Dyes cotton, wool, silk, and artificial silk from a crimson hydrosulphite vat pure yellow, fast to washing, light and chlorine. Used in conjunction with other vat dyes for dyeing compound shades; also in calico printing.	

Ciba Yellow 5R (SCI) Component— Ciba Yellow G (No. 1196) reduced (in absence of caustic alkali). No. 1197	A dull yellow paste. H_2SO_4: Orange-brown solution, orange-yellow precipitate on dilution. Dyes cotton from a crimson hydrosulphite vat yellow, fast to washing, light and chlorine.
Ciba Green G paste (SCI) Dibromo-bis-β-naphthindole-indigo. No. 1198 (891)	A greenish-black paste, or greenish-black powder with a greenish cast when dry, which sublimes in reddish-violet vapours to a limited extent on heating, although the major portion chars. In xylene-λ = 619.2. H_2O: Insoluble. Xylene: Green solution. H_2SO_4: Bluish-green solution, green precipitate on dilution. Dyes cotton from a brownish-yellow hydrosulphite vat bright green (levels badly), rendered blue by vigorous washing and not fast to chlorine. Used also in calico printing.
Helindone Green G paste, (MLB) Brominated bis-β-naphthindole-indigo. No. 1199 (892)	A greenish-black paste, or greenish-black powder when dry. In xylene: λ = 635. and 586. H_2O: Insoluble. Xylene: Green solution. H_2SO_4: Blackish-green solution, olive-green flocculent precipitate on dilution. Dyes cotton from a brownish-yellow hydrosulphite vat bright green. Used also in calico printing.
Alizarine Indigo 3R paste, (By) 2-(5:7-Dibromoindole)-2′-(4′-bromonaphthalene)-indigo. No. 1200 (895)	A dark blue paste, or blackish-blue powder when dry, which sublimes in violet vapours on heating and deposits a blue sublimate. H_2O: Insoluble. Xylene: Blue solution. H_2SO_4: Bluish-green solution, blue flocculent precipitate on dilution. Dyes cotton and wool from a light yellow hydrosulphite vat blue, fast to chlorine and soap in the former case, and fast to light, stoving, carbonising and milling in the latter case; the shade is redder and faster to light than Alizarine Indigo G (No. 1202). Used mainly in calico printing with potassium carbonate and hydrosulphite. When printed with starch paste and chromium acetate and steamed, useful grey shades of excellent fastness to light and washing are obtained.

Alizarine Indigo B (By) 2-(5:7-Dibromoindole-) 3'-acenaphthene-indigo. No. 1201 (894)	A blackish-brown paste, or blackish-blue powder, which sublimes in violet vapours on heating. H_2O: Insoluble. Xylene: Blue solution. H_2SO_4: Dull yellowish-green solution, blue precipitate on dilution. Dyes cotton and wool from a brownish-yellow hydrosulphite vat blue, fast to chlorine and soap in the case of cotton, and fast to light, stoving, carbonising and milling in the case of wool. Used mainly in calico printing with potassium carbonate and hydrosulphite. When printed with starch paste and chromium acetate and steamed, useful grey shades of excellent fastness to light and washing are obtained.
Alizarine Indigo G pdr. (By) 2-(5:7-Dibromoindole)-2'-anthracene-indigo. No. 1202 (893)	A blackish-blue powder, which partly sublimes in blue vapours on heating. In xylene: λ = 653 and 606. H_2O: Insoluble. Xylene: Blue solution. HCl: Unaltered. NaOH: Unaltered. H_2SO_4: Olive-green solution, blue precipitate on dilution. Dyes cotton and wool from a brownish-yellow hydrosulphite vat level greenish-blue, fast to chlorine and acids, of good fastness to washing and boiling, and faster to light than Indigo in the case of cotton, and fast to light, stoving, carbonising and milling in the case of wool; the fastness to cross-dyeing is increased by after-treatment with dichromate and copper sulphate; the shade is resistant to the action of concentrated nitric acid. Used also in calico printing.
Helindone Blue 3GN (MLB) 2-Indole-2'-oxyanthrol-indigo. No. 1203 (896)	A bluish-grey powder (diluted with soda). In xylene: λ = 706 and 654.5. H_2O: Insoluble. Xylene: Bluish-green solution. Alcohol: Insoluble. H_2SO_4: Dark wine-red solution, green flocculent precipitate on dilution. Dyes cotton from a yellowish-brown hydrosulphite vat bright greenish-blue of good fastness to washing, acids, chlorine and light, and wool brighter and greener shades than with Indigo. Used also for dyeing compound shades in conjunction with Helindone Yellow 3GN (No. 1138); also in calico printing.

Indirubin Indigo Red Indipurpurin 2:3′-Bis-indole-indigo or isatin-β-indogenide. No. 1204	A dark red powder, which sublimes in crimson needles at 340° without decomposition. H_2O: Insoluble. Alcohol: Violet solution from which the Indirubin crystallises, on cooling, in bundles of dark purple needles. HCl: Unaltered. NaOH: Unaltered. H_2SO_4: Deep crimson solution. Dyes wool and cotton from the vat crimson, fast to light; the shade produced from the vat becomes progressively bluer owing to the production of indoxyl by the further reduction of leuco-Indirubin and consequent formation of Indigo on oxidation; Indirubin is converted during dyeing, rapidly in a zinc dust-lime vat but less quickly in a hydrosulphite or other vat, into not more than one-half its weight of Indigo. Indirubin is valueless as a vat dye, but Indirubin disulphonic acid dyes wool from an acid bath red, much faster to light than Indigo Extract (No. 1180). Used for dyeing wool in the form of its sulphonic acid, and for the manufacture of Ciba Heliotrope B (No. 1205) by bromination.	
Ciba Heliotrope B (SCI) 5:7:5′:7′-Tetrabromo-indirubin or 2:3′-(5:7:5′:7′-tetrabromo-indole)-indigo. No. 1205 (897)	A dark violet powder which sublimes in reddish-violet vapours on heating. In xylene: λ = 579.5 and 537. H_2O: Insoluble. Xylene: Sparingly soluble, with a magenta-red colour. HCl: Insoluble. NaOH: Insoluble. H_2SO_4: Blackish-green solution, violet precipitate on dilution. Dyes cotton, wool and silk from a yellowish-olive hydrosulphite vat heliotrope of only moderate fastness to light, washing and chlorine, and not fast to boiling. Used in calico printing as a substitute for Iron Lilac (*i. e.* Alizarine on an iron mordant).	
Helindone Violet D paste (MLB) Brominated 7-methyl-indirubin. No. 1206 (898)	A dark violet paste, or blackish-violet powder when dry, which sublimes in violet vapours on heating. H_2O: Insoluble. Xylene: Magenta-red solution. HCl: Unaltered. NaOH: Unaltered. H_2SO_4: Green solution, violet flocculent precipitate on dilution. Dyes cotton, wool and silk from a yellow hydrosulphite vat violet of good fastness to washing and light, and of moderate fastness to chlorine.	No longer upon the market.

	Used in machine dyeing and in calico printing.
Thioindigo Red B (K) Formerly Durindone Red B paste (BDC) (Lev) Ciba Pink B (SCI) 2:2′-Bis-thionaphthene-indigo- or thioindigo. No. 1207 (912)	A bluish-red 20% paste, or bluish-red powder, which sublimes in bluish-red vapours on heating and deposits reddish-brown crystals with a metallic reflex. In xylene: λ = 544 and 502. H_2O: Insoluble. Alcohol: Partly soluble with a bluish-red colour. Xylene: Red solution with a yellow fluorescence. HCl: Insoluble. NaOH: Insoluble. H_2SO_4: Green solution, bluish-red flocculent precipitate on dilution. Dyes cotton, wool and silk from a yellow hydrosulphite vat, or cotton from a sodium sulphide bath, bluish-red. *Thioindigo Red B* requires about one-half as much hydrosulphite for reduction as is required by Indigo. Cotton is dyed at about 20–24°, and wool at about 60°. Used largely for dyeing wool and in calico printing; also for dyeing silk and for dyeing unions of woo and silk. Discharged white by hydrosulphite on cotton. Thioindigo Red B can be detected readily in presence of Indigo, even if present only in traces, by heating the dyed material with a dilute solution of chromic acid. The Indigo is destroyed completely and, after washing, the Thioindigo Red B remains unaltered.
Ciba Bordeaux B (SCI) 5:5′-Dibromo-2:2′-bis-thionaphthene-indigo. No. 1208 (919)	A reddish-violet powder, which sublimes in red vapours on heating. In xylene- = 555.5 and 513.8. H_2O: Insoluble. Xylene: Bluish-red solution with a faint yellow fluorescence. HCl: Insoluble. NaOH: Insoluble. H_2SO_4: Yellowish-green solution, bluish-violet precipitate on dilution. Dyes cotton from a yellowish-orange hydrosulphite vat Bordeaux-red, fast to chlorine, light and washing. Used in machine dyeing; also for dyeing wool; also in calico printing.
Thioindigo Red BG (K) Helindone Red B (MLB) 5:5′-Dichloro-2:2′-bis-thionaphthene-indigo. No. 1209 (917)	A bluish-red powder, which sublimes in reddish-brown vapours on heating. In xylene: λ = 547.25 and 504. H_2O: Insoluble. Xylene: Red solution with a yellow fluorescence. HCl: Unaltered. NaOH: Unaltered. H_2SO_4: Yellowish-green solution, red precipitate on dilution.

	Dyes cotton, wool and silk from a yellowish-olive hydrosulphite vat red. Used in machine dyeing and in calico printing; also in conjunction with orange, brown, and blue vat dyes for dyeing compound shades.	
Ciba Red B (SCI) 6:6′-Dichloro-2:2′-bis-thionaphthene-indigo. No. 1210 (909)	A dark red powder, which sublimes in red vapours on heating. H_2O: Insoluble. Xylene: Red solution with a yellow fluorescence. H_2SO_4: Green solution, red flocculent precipitate on dilution. Dyes cotton, wool and silk from a yellow hydrosulphite vat bluish-red, very fast to milling, washing and light, and moderately fast to chlorine. Used in machine dyeing; also in calico printing, alone or in conjunction with dyes such as Ciba Scarlet G (No. 1228) for pink shades, &c.	
Thioindigo Pink AN, BN (K) Helindone Pink BN paste, (MLB) 6:6′-Dibromo-4:4′-dimethyl-2:2′-bis-thionaphthene-indigo. No. 1211 (910)	*Thioindigo Pink AN*— Brownish-red paste, or Bordeaux-red powder when dry, which sublimes in red vapours on heating. In xylene: λ = 642 and 501. Xylene: Bluish-red solution with a yellow fluorescence. H_2SO_4: Dull greenish-blue solution, reddish flocculent precipitation on dilution. Dyes cotton from a brownish-yellow hydrosulphite vat pink of good fastness to washing, light, alkalies and rubbing. Used in machine dyeing; also for dyeing silk; also in calico printing. Discharged white by hydrosulphite in presence of Leucotrope on cotton.	
Thioindigo Red 3B (K) Durindone Red 3B paste (BDC) Indanthrene Red-Violet RH paste, RH pdr. 5:5′-Dichloro-6:6′-dimethyl-2:2′-bis-thionaphthene-indigo. No. 1212 (918)	A dark bluish-red powder, which sublimes in red vapours on heating; 4½ parts paste = 1 part powder. In xylene: λ = 562 and 520.7. H_2O: Insoluble. HCl: Unaltered. NaOH: Unaltered. H_2SO_4: Greenish-olive solution, red precipitate on dilution. Dyes cotton, wool and silk from a yellowish-olive hydrosulphite vat bright magenta-red. Used in calico printing alone or in conjunction with Indigo MLB/2B (No. 1183), MLB/4B (No. 1184), &c., for fast violet and heliotrope shades.	
Thioindigo Grey 2B paste, (K) Indanthrene Grey 6B paste, 6B pdr. Formerly— Helindone Grey 2B	A dark bluish-green paste, or bluish-green powder (about 3.6 parts paste = 1 part powder), which sublimes in violet vapours and chars on heating. H_2O: Insoluble. Xylene: Sparingly soluble, with a reddish-violet colour. H_2SO_4: Deep blue	

paste, 2B pdr. (MLB) 7:7′-Diamino-2:2′-bis-thionaphthene-indigo. No. 1213 (921)	solution; red solution and then bluish-red flocculent precipitate on dilution. Dyes cotton, wool and silk from a yellow hydrosulphite vat at 40–50° bluish-grey. Used in machine dyeing; also in calico printing.	
Helindone Grey BR (MLB) 5:5′-Dichloro-7:7′-di-amino-2:2′-bis-thio-naphthene-indigo. No. 1214 (921)	A blackish-blue paste, or blackish-blue powder when dry. H_2O: Insoluble. Nitrobenzene: Deep blue solution hot. H_2SO_4: Blue solution, crimson solution and then dark blue precipitate on dilution. Dyes wool and silk from a yellow hydro-sulphite vat steel-blue to blackish-blue, faster than Helindone Grey 2B (No. 1213). Unsuitable for dyeing cotton.	
Helindone Orange D paste (MLB) 5:5′-Dibromo-6:6′-di-amino-2:2′-bis-thio-naphthene-indigo. No. 1215 (914)	A brownish-orange paste, or brownish-red powder when dry. H_2O: Insoluble. H_2SO_4: Cornflower-blue solution, brown-ish-yellow precipitate on dilution. Dyes cotton, wool and silk from a dark yellow hydrosulphite vat clear orange, fast to washing, light and chlorine. Used also in calico printing and in machine dyeing.	
Thioindigo Scarlet S (K) Helindone Scarlet S (MLB) 6:6′-Diethylthio-2:2′-bis-thionaphthene-indigo. No. 1216 (916)	A reddish-orange powder which decom-poses on heating. In xylene: $\lambda = 535.3$ and extinction in the violet. H_2O: Insoluble. Xylene: Yellowish-red solution. H_2SO_4: Bluish-green solution, orange precipi-tate on dilution. Dyes cotton from a yellowish-orange hydrosulphite vat scarlet-red; the tinctorial power is only moderate. Vegetable fibres are tendered by vat dyes of this type containing alkylthio-groups, but this effect is counteracted, by after-treatment with copper sul-phate or ferrous sulphate and, at the same time, the fastness to light is increased: (G. P. 206567, 206568). Used also in calico printing for bright scarlet shades.	
Thioindigo Orange R (K) Helindone Orange R paste, (MLB) 6:6′-Diethoxy-2:2′-bis-thionaphthene-indigo. No. 1217 (913)	An orange powder which sublimes in yellowish-red vapours on heating. In H_2SO_4: $\lambda = 577.5$, 530.2 and 490.5. H_2O: Insoluble. HCl: Unaltered. NaOH: Unaltered. H_2SO_4: Reddish-blue solution, orange precipitate on dilution. Dyes cotton, wool and silk from an orange hydrosulphite vat orange.	

	Used also in calico printing.	
Helindone Fast Scarlet R (MLB) 5:5′-Dibromo-6:6′-diethoxy-2:2′-bis-thionaphthene-indigo. No. 1218 (915) Helindone red 3B is made from *m*-chloro-*o*-toluidine	A yellowish-red powder which sublimes in yellowish-red vapours on heating. H_2O: Insoluble. Xylene: Yellowish-red solution. H_2SO_4: Cornflower-blue solution, yellowish-red precipitate on dilution. Dyes cotton, wool and silk from a greenish-yellow hydrosulphite vat red. Used for dyeing upholstery materials, yarns, &c.; also in machine dyeing and in calico printing. Important.	
Thioindigo Violet 2B (K) Helindone Violet B paste, BB paste, R paste (MLB) 4:4′-Dimethyl-5:5′-dichloro-7:7′-dimethoxy-2:2′-bis-thionaphthene-indigo. No. 1219 (920)	*Helindone Violet paste.* A dark violet paste, or dark violet powder when dry. H_2O: Insoluble. Xylene: Reddish-violet solution with a brownish-red fluorescence. H_2SO_4: Green solution, reddish precipitate on dilution. Dyes cotton, wool and silk from a yellowish-olive hydrosulphite vat bluish-violet. Used in machine dyeing and in calico printing.	
Ciba Grey G (SCI) 2- (5-Bromoindole)-2′-thionaphthene-indigo. No. 1220 (899)	A grey powder which sublimes in reddish-violet vapours on heating. H_2O: Insoluble. H_2SO_4: Green solution, violet precipitate on dilution. Dyes cotton, wool and silk from a yellow hydrosulphite vat blue, converted by treatment with soap, or soap and soda in the case of vegetable fibres, or by treatment with dilute acids or dichromate in the case of animal fibres, into grey of good fastness to light, washing and chlorine. Used also in machine dyeing and in calico printing.	
Ciba Violet 3B (SCI) Thioindigo Violet K (K) 2- (5-Bromoindole)-5′-bromo-2′-thionaphthene-indigo. No. 1221 (900)	A red-violet powder which sublimes in reddish-violet vapours. In xylene: λ = 587.5 and 545.5. H_2O: Insoluble. Xylene: Reddish-violet solution. HCl: Insoluble. NaOH: Insoluble. H_2SO_4: Bluish-green solution, bluish-violet precipitate on dilution. Dyes cotton, wool, silk and artificial silk from an orange hydrosulphite vat bluish-violet. Used also in calico printing.	
Ciba Violet B (SCI)	A reddish-violet powder which sublimes in reddish-violet vapours on heating. In xylene: λ = 587.7 and 547.5. H_2O: Insoluble.	

2-(5:7-Dibromoindole)-5′-bromo-2′-thionaphthene-indigo. No. 1222 (901)	Xylene: Reddish-violet solution. H_2SO_4: Green solution, reddish-violet precipitate on dilution. Dyes cotton, wool and silk from an orange hydrosulphite vat very pure violet of good fastness to washing and chlorine, but of only moderate fastness to light and not fast to boiling. Used also in calico printing for shirting materials.
Thioindigo Brown R (K) Helindone Brown 2R paste, (MLB) Brominated 2-indole-2′-(amino-thionaphthene)-indigo. No. 1223 (902)	A red-brown paste, or powder when dry. In xylene: $\lambda = 578$ and 533.0. H_2O: Insoluble. Xylene: Reddish-brown solution. Alcohol: Insoluble. H_2SO_4: Dark violet solution, reddish-brown precipitate on dilution. Dyes cotton, wool and silk from a dark orange-yellow hydrosulphite vat brown of good fastness to washing, light, water and acids. Used mainly for dyeing cotton and in calico printing; also in machine dyeing.
Thioindigo Brown 3R (K) Helindone Brown 5R paste, (MLB) Components— Nitroisatin and 6-aminothioindoxyl; reduced and brominated. No. 1224 (903)	A brown paste, or a powder when dry. In xylene: $\lambda = 566.5$ and 518.5. H_2O: Insoluble. Xylene: Sparingly soluble with a reddish-brown colour. H_2SO_4: Bluish-green solution, reddish flocculent precipitate on dilution. Dyes cotton, wool and silk from a dark yellow hydrosulphite vat brown of good fastness to washing and acids. Used mainly for dyeing cotton and in calico printing; also in machine dyeing.
Thioindigo Scarlet R paste Durindone Scarlet R (BDC) (Lev) (K) 3-Indole-2′-thionaphthene-indigo. No. 1225 (905)	A red paste, or a red powder when dry, which sublimes in brown vapours on heating. H_2O: Insoluble. Alcohol: Sparingly soluble, with a yellowish-red colour. HCl: Unaltered. NaOH: Unaltered. H_2SO_4: Brown solution, red precipitate on dilution. Dyes cotton, wool and silk from a cold faintly yellow hydrosulphite vat scarlet-red. Used also in calico printing.
Ciba Red G Durindone Red Y (BDC) (SCI) Thioindigo Scarlet G (K)	A red-brown powder which sublimes in brown vapours on heating. H_2O: Insoluble. Xylene: Sparingly soluble with a yellowish-red colour and a faint yellow fluorescence. H_2SO_4: Olive-brown solution, red precipitate on dilution.

3-(5:7-Dibromoindole)-2′-thioaphthene-indigo. No. 1226 (906)	Dyes cotton, wool and silk from a light yellow hydrosulphite vat yellowish-red.	
Thioindigo Brown G paste, (K) Helindone Brown G paste, (MLB) Tribrominated 3-indole-2′-(6′-aminothionaphthene)-indigo. No. 1227 (904)	A brown paste, or brown powder when dry, which sublimes in vapours on heating. H_2O: Insoluble. HCl: Unaltered. NaOH: Unaltered. H_2SO_4: Magenta-red solution, brown precipitate on dilution. Dyes cotton, wool, and silk from a yellowish-brown hydrosulphite vat brown. Used also in calico printing and in machine dyeing.	
Ciba Scarlet G, (CAC) (SCI) Thioindigo Scarlet, 20 (K) Helindone Fast Scarlet C, (MLB) 2-Thionaphthene-2-acenaphthylene-indigo. No. 1228 (907)	A red powder which sublimes in reddish-brown vapours and crystallises from nitrobenzene in In xylene: $\lambda = 518.0, 470.0$ (not distinct). H_2O: Insoluble. Xylene: Sparingly soluble with a yellowish-red colour. H_2SO_4: Grass-green solution, red flocculent precipitate on dilution. Dyes cotton, wool, and silk from a turbid Bordeaux-red hydrosulphite vat scarlet-red; a sodium sulphide vat can also be used. Used also in calico printing.	
Ciba Red R paste (SCI) Monobromo-2-thionaphthene-2′-acenaphthylene-indigo. No. 1229 (908)	A red paste, or red powder when dry, which sublimes in red-brown vapours on heating. In xylene: $\lambda = 520.7$ and 476.5 (not distinct). H_2O: Insoluble. Xylene: Sparingly soluble with a yellowish-red colour. HCl: Unaltered. NaOH: Unaltered. H_2SO_4: Bluish-green solution red precipitate on dilution. Dyes cotton, wool, and silk from a reddish-violet hydrosulphite vat red, of good fastness to washing, light and chlorine.	
Ciba Orange G, paste (SCI) Tribrominated 6-amino-2-thionaphthene-2′-acenaphthylene-indigo. No. 1230 (911)	An orange paste, or an orange powder when dry. λ, not known. Alcohol: Insoluble. Xylene: Sparingly soluble with a yellow colour. H_2SO_4: Greenish-blue solution, yellowish-brown precipitate on dilution. Dyes cotton, wool, and silk from a dull brownish-violet hydrosulphite vat pure orange, very fast to washing, and of good fastness to light and chlorine on cotton, and very fast to milling, washing and potting on wool.	

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THE SYNTHETIC DYESTUFFS

BY A. W. JOYCE

CLASSIFICATION OF THE SYNTHETIC DYESTUFFS

The very large number of synthetic dyestuffs which have been prepared show that their dyeing property is dependent upon the structure of the molecule and that the dyestuff contains in its molecule certain well defined groups which have the character of imparting colour and dyeing properties to the product.

According to O. Witt, the character of a dyestuff is derived from some group which he calls the "Chromophore," and the basic or fundamental nucleus containing the chromophore he calls the "Chromogen." The chromogen is not in itself a dyestuff, but is converted thereto by the entrance of some salt-forming group which he terms the "auxochrome."

A simple example to illustrate this generalisation by Witt is aminoazobenzene, $C_6H_5—N{=}N—C_6H_4—NH_2$. The chromophore here is the azo group, $—N{=}N—$; the chromogen is azo-benzene, $C_6H_5N{=}N—C_6H_5$; and the auxochrome is the amino group, $—NH_2$, which confers salt-forming properties and destroys the chemically inert character of the chromogen.

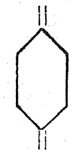
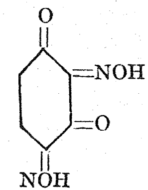
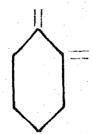
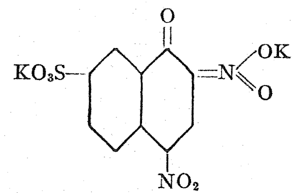
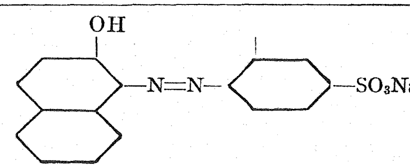
It would seem from this that every dyestuff must have salt-forming properties and would therefore contain either acid or basic groups. Exceptions, however, are found in the very important Sulphur and Vat dyestuffs, which are insoluble in water, alkali or acid, and must be reduced to their "leuco" compounds which yield the dyestuff again on oxidation.

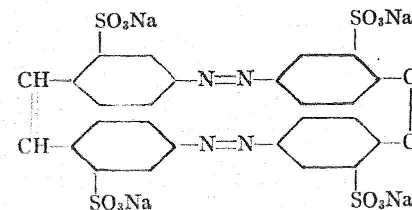
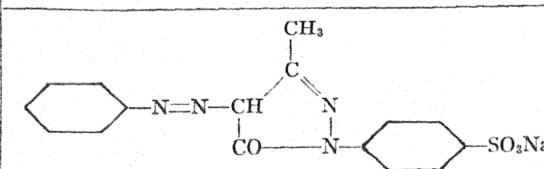
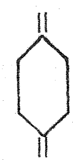
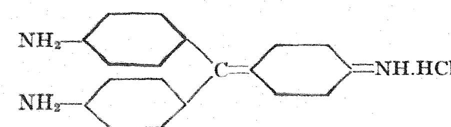
Several schemes for the classification of dyestuffs might be used depending upon the purpose for which each dyestuff is required. It is frequently convenient to classify them according to their behaviour on dyeing, and for this purpose they may be sub-divided into acid dyes, basic dyes, mordant dyes, etc., but this would lead to confusion from a chemical classification standpoint, since, for

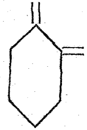
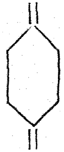
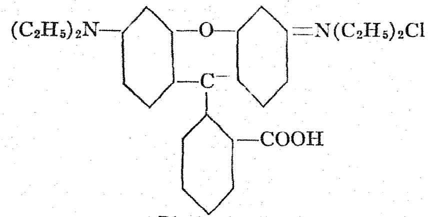
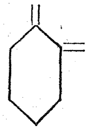
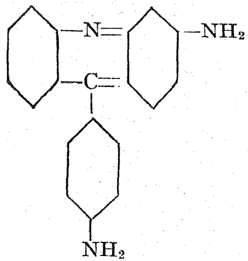
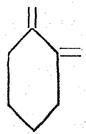
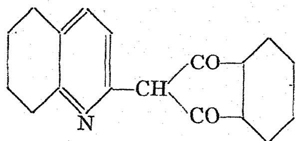
example, the sub-division under acid dyes would include members of the Azo, Anthraquinone and other groups.

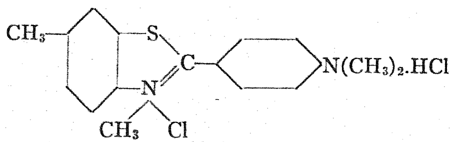
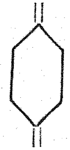
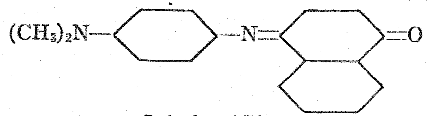
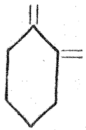
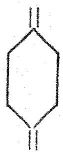
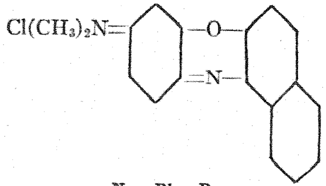
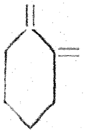
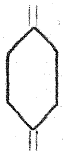
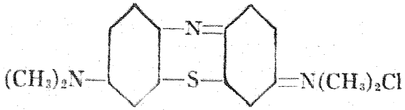
Since the purpose of this work is for use in the chemical identification of dyestuffs, it is most practical to adopt a chemical classification; so that the method as used in the well-known Schultz "Farbstofftabellen" and enlarged in the "Colour Index" will serve the purpose.

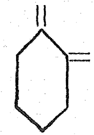
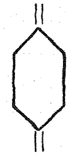
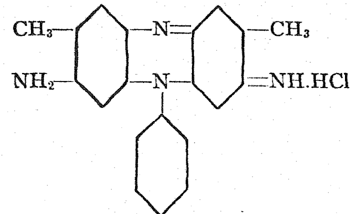
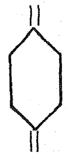
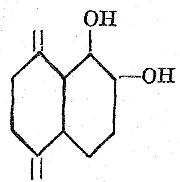
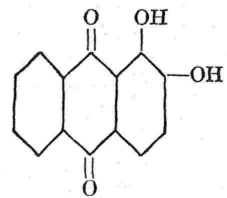
The classification according to chemical constitution divides the dyestuffs into the following groups:

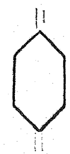
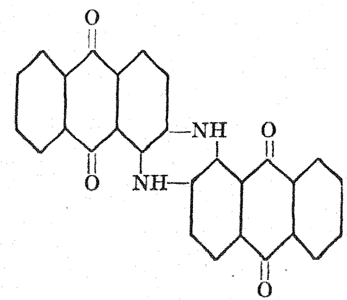
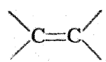
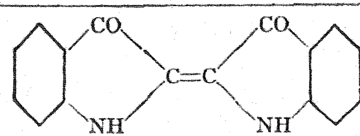
Dyestuff group	Chromophore	Typical dyestuff
1. Nitroso...........................		 Fast Green O
2. Nitro.............................		 Naphthol Yellow S
3. Azo...............................	—N=N— or 	 Orange II

4. Stilbene........................	—N=N—	 Mikado Orange
5. Pyrazolone........................	—N=N—	 Fast Light Yellow
6. Carbonium: A. Di- and Triphenyl-Methane......		 Magenta

Dyestuff	Chromophore	Typical dyestuff
B. Xanthone.	 or 	 **Rhodamine B**
7. Acridine.		 **Phosphine**
8. Quinoline.		 **Quinoline Yellow**

9. Thiazole..........................	—C═N—	 Thioflavine T
10. Indophenol and Indamine...........		 Indophenol Blue
11. Oxazine..........................	 or 	 New Blue R
12. Thiazine..........................	 or 	 Methylene Blue

Dyestuff group	Chromophore	Typical dyestuff
13. Azine..............................	 or 	 Safranine
14. Sulphur..........................	Probably 	Immedial Pure Blue (Constitution Unknown)
15. Hydroxy-Ketone..................		 Alizarine

16. Anthraquinone....................		 Indanthrene Blue R
17. Indigo and Thioindigo.............		 Indigo

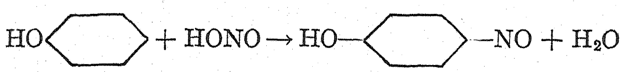
It should be borne in mind that some dyestuffs contain more than one chromophore; this is true especially in the case of Anthraquinone, Hydroxy-ketone and Indigo Dyestuffs, so that the above indication of chromophore groups for each class of dyestuff is an attempt to show that colour in all synthetic dyestuffs may pretty generally be ascribed to a chromophore having a quinoid linkage.

The Nitroso Dyestuffs

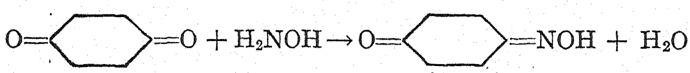
(Quinoneoximes)

All the members of this class have the character of nitroso-phenols and are made commercially by the action of nitrous acid on phenols or phenolic compounds.

The product *p*-nitroso-phenol is produced by the action of nitrous acid on phenol



and since this same nitroso-phenol is made from *p*-quinone and hydroxylamine,



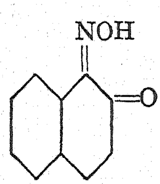
p-quinoneoxime

it shows that these products can behave as quinoneoximes. However, only those compounds which possess an ortho-quinone grouping have tinctorial value.

The nitroso dyestuffs find a limited application, as their value depends upon the property of forming lakes with iron and chrome mordants, and they are used for wool dyeing and calico printing.

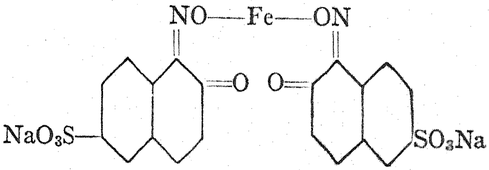
Fast Green O (H) (M) (C.I. 1)[1] is produced by the action of nitrous acid on resorcinol.

Fast Printing Green (BDC) (By) (K) (A) (C.I. 2) is 1-Nitroso-2-naphthol and has the formula



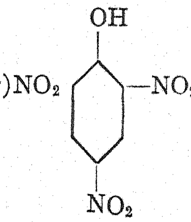
[1] Refers to the number given to the dye in the British Colour Index.

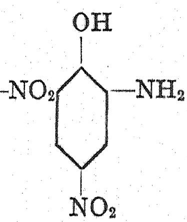
Naphthol Green B (C) (BDC), Naphthol Green (T.C.)[1] (C.I. 5) is the iron compound of 1-nitroso-2-naphthol-6-sodium sulphonate



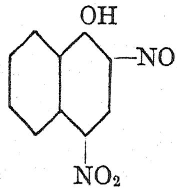
The Nitro Dyestuffs

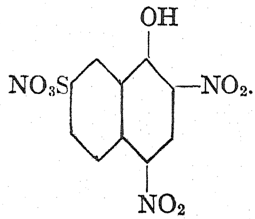
The Nitro Dyestuffs constitute a small group of colouring matters which, on account of their fugitive nature, have been replaced to a large extent in recent years, for the most part, by the azo dyestuffs. The Nitro colours are for the most part used for silk and wool dyeing.

Picric Acid (*C.I.* 7)  is probably the oldest synthetic dyestuff, as it was prepared by the action of nitric acid on indigo as far back as the eighteenth century. It is made commercially by treating phenol-sulphonic acid with nitric acid. It is of no importance as a dyestuff at the present time, but is used for making

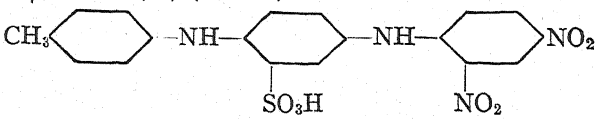
Picramic Acid—  which is used as a component for the production of some azo colours.

[1] (T.C.) indicates that the name for the dye is that adopted by the U. S. Tariff Commisson for dyes manufactured in the United States and reported in the Census of Dyes for 1925.

Martius Yellow (Gy) (A) (C.I. 9) is the sodium salt of 2.4-dinitro-1-naphthol  and can be prepared by nitrating 1-naphthol sulphonic acid.

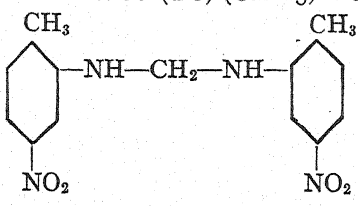
Naphthol Yellow S (TC) (C.I. 10) is the most important dye of this group and is the potassium salt of 2.4-dinitro-1-naphthol-7-sulphonic acid, . It is made by the action of nitric acid on 1-naphthol di- or tri-sulphonic acid.

Amido Yellow E (M) (C.I. 11)



is made by condensing amino-tolyl-phenylamine-sulphonic acid with chloro-dinitro benzene (A.P. 1059571; E.P. 13672 of 1912; G.P. 263655). It is a representative of a more recent class of nitro dyestuffs.

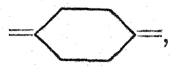
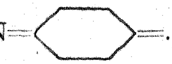
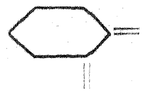
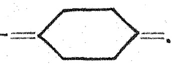
Certain methylene derivatives of nitro-amines are of value as pigment colours. Thus by the action of formaldehyde on 4-nitro-2-toluidine *Pigment Chlorine GG* (TC) (C.I. 13) is obtained.



Lithol Fast Yellow GG (B) (C.I. 14) is prepared in a similar manner from 3-chloro-6-nitraniline (A.P. 932,266; G.P. 212,594).

The Azo Dyestuffs

The group of Azo Dyestuffs forms the largest class of synthetic colouring matters, some of which have acid, some basic, some neutral, and some mordant-dyeing properties.

They all contain one or more of the characteristic azo grouping, —N=N—, which is the chromophore. On the other hand, in their hydrazone form the azo compounds may be considered to contain the quinoid structure, that is , and the chromogen would then be represented as follows, R—NH—N. In some cases this will take the ortho form, that is  as distinguished from the para—.

General Methods of Formation

In general, the azo dyestuffs are made by combining the diazo compound of an aromatic amine or amino derivative with an aromatic hydroxy compound or with another amino compound or with compounds which have the character of both amines and phenols.

In most cases the diazo compounds are readily formed by the action of nitrous acid, from sodium nitrite and an acid, on an amine. However, other groups substituted in the aromatic nucleus have a marked effect not only on the stability of the diazo compound, but also on the facility with which it is formed. Nitro-amines are more difficult to diazotise, especially the ortho compounds, and 2.4-dinitro-aniline is best diazotised in concentrated sulphuric acid solution. Ortho-amino-phenols also require special treatment, since with these derivatives nitrous acid often exercises an oxidising action, but in the presence of copper or zinc salts the process goes smoothly.

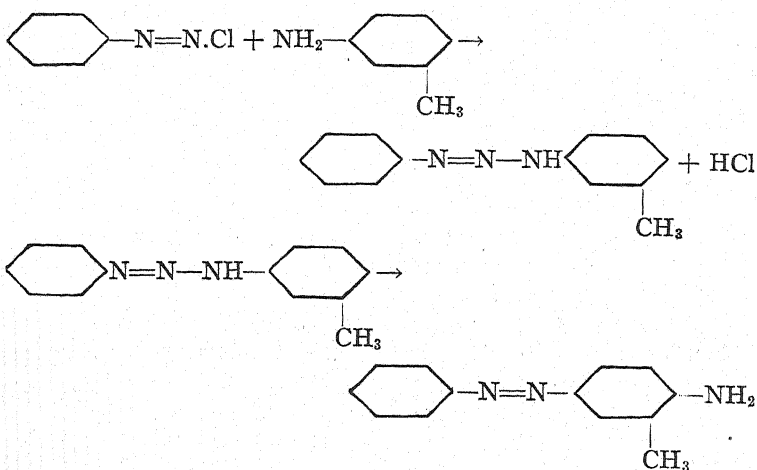
In order to carry out the diazotisation process it is necessary to establish certain conditions of temperature, concentration of acid, etc., for each case, as the various amines behave in different ways during the operation.

To form the azo derivative, the diazo compound is combined with a second component which may be either a hydroxy compound or another amine. This operation is called coupling, and with hydroxy compounds or phenols is carried out in an alkaline medium, the acid in the solution of the diazo compound either being first neutralised or sufficient alkali (soda) added to the solution of the phenol, so that an alkaline reaction is obtained at the end of the operation.

If the second component is an amine the coupling must be done in either a neutral or weakly acid solution.

In the benzene series the azo group usually enters the para-position to the —OH or —NH_2 group; if this is occupied, it enters in the ortho-position.

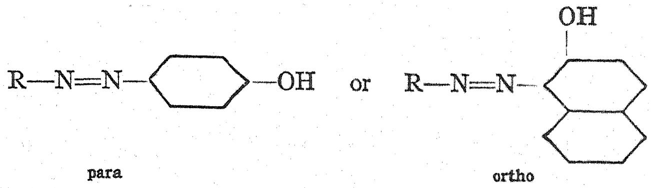
In coupling a diazo compound with an amine, a diazo-amino compound is first formed which rearranges itself into an amino-azo configuration.



Diazo-amino compound **Amino-azo compound**

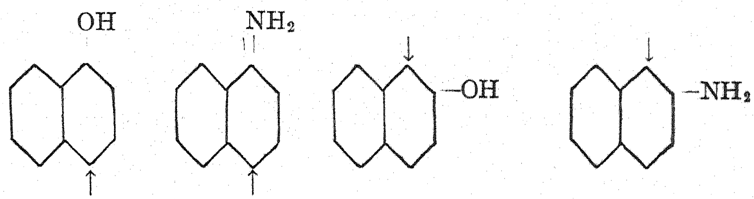
These bases can then be further diazotised and coupled again with suitable components. Thus it will be seen that the para-amino-azo compounds are valuable as secondary intermediate products, as well as for use as colouring matters. The ortho-amino-azo-compounds are generally not diazotisable and are therefore of value only as dyestuffs.

If the second component be a phenol, the product formed by coupling with a diazo compound is either an ortho- or para-oxy-azo dyestuff:

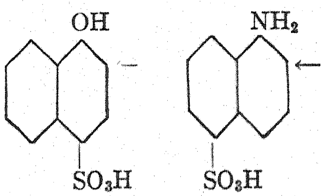


and, in general, the ortho-oxy-azo dyestuffs are the most valuable.

In the naphthalene series the position taken by the entering azo group, while exhibiting certain general tendencies, is nevertheless influenced by the presence of groups substituted in the molecule. With simple derivatives, such as the naphthols and naphthylamines, the entering azo group takes the positions as indicated by the arrows:

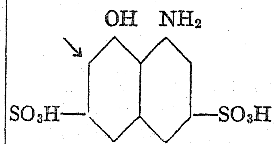
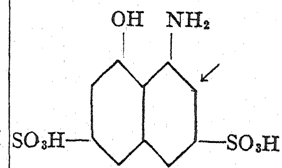
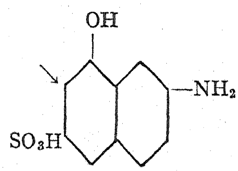
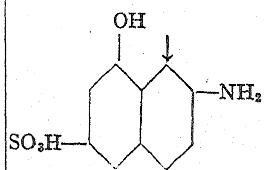
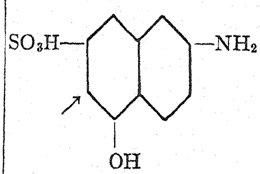
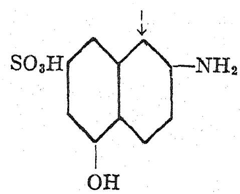
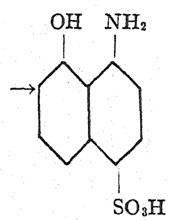
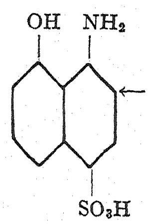


If sulphonic acid groups are present in positions (3), (4) or (5) in (1), or alpha-naphthol or naphthyl-amine, the azo group enters at position (2):



The amino-naphthol sulphonic acids combine in different ways with diazo compounds depending upon whether the coupling is made in an alkaline or acid solution, yielding ortho-oxy-azo dyes in alkaline solution and ortho-amino-azo dyes in acid solution.

The position of the entering azo group in the more important amino-naphthol-sulphonic acids is shown as follows:

	Coupling	
	Alkaline	Acid
1.8-Aminonaphthol-3.6-disulphonic acid (H-Acid)		
2.8-Aminonaphthol-6-sulphonic Acid (Gamma Acid)		
2.5-Aminonaphthol-7-sulphonic Acid (J-Acid)		
1.8-Aminonaphthol-4-sulphonic Acid (S-Acid)		

If one azo group has been coupled, either in acid or alkaline solution, it is impossible to introduce a second molecule of a diazo compound, except in the case of the 1.8-acids, such as H-Acid, S-Acid etc. This also applies to the 1.8-dioxy- and 1.8-diamino-acids.

Exceptions to the general behaviour for the formation of azo compounds are known, but it is not the purpose in this section to discuss all of the methods by which azo compounds are formed.

For a more complete and comprehensive survey of this subject as well as for a discussion of the influence of the constitution of azo compounds upon colour, other works should be consulted, such as Georgievics, "Dye Chemistry," E. R. Watson's "Colour and Constitution."

It can readily be seen that with the large number of intermediate products which are available, together with new ones that are constantly being discovered, the number of azo combinations is almost limitless. In fact, an inconceivable number has been made, but only a small proportion of these have found commercial application, and some which were used extensively twenty, thirty or forty years ago are today replaced by other combinations which either have better fastness properties, or they have gone out of use owing to changing methods in the consuming industries.

In order to facilitate the study of the azo dyes from a chemical standpoint, they have been sub-divided into several groups; those exhibiting similar chemical characteristics in general show analogous dyeing properties. Only the more important technical dyes will be mentioned, as it is obviously outside the scope of this section to attempt a complete discussion of all the azo dyes; however, some of the more recent dyes which have found commercial application will be presented in their proper places.

The azo dyes are most conveniently sub-divided into the following groups:

1. Basic Azo Dyes
2. Acid Monazo Dyes
3. Pyrazolone Dyes
4. "Ice Colours"
5. Acid Disazo Dyes
6. Substantive or Direct Cotton Dyes
   A. Dyes from Benzidine and other bi-nuclear bases
   B. J-acid Dyes
   C. Dyes from aromatic diamines
   D. Thiazole Dyes
   E. Stilbene Dyes

The Basic Azo Dyes

The basic azo dyes comprise a small but important class of colouring matters. They are soluble in alcohol, oils, fats etc., and for this

reason are valuable for the colouring of varnishes, waxes, etc. However, they find extensive use in the dyeing of cotton, leather and wool.

Spirit Yellow G (C.I. 15) amino-azobenzene,

$$C_6H_5—N=N—C_6H_4—NH_2$$

the first azo dye made, is fugitive and finds its chief use as a raw material for the manufacture of other azo dyes and also as a spirit-soluble colour.

Butter Yellow (TC) (C.I. 19) is the dimethyl derivative of Spirit Yellow G.

Chrysoidine Y (TC) (C.I. 20):

$$C_6H_5—N=N—C_6H_3\begin{cases} NH_2\ (1) \\ NH_2\ (3) \end{cases}$$

is made from aniline and *m*-phenylene diamine.

Chrysoidine R (TC) (C.I. 21): is made similarly to Chrysoidine Y, but by using *o*-toluidine in place of aniline.

Bismarck Brown (TC) (C.I. 331), (*Manchester Brown*) is made by the action of nitrous acid on *m*-phenylene-diamine. If *m*-toluylene diamine is used, a similar colour is formed, known as *Bismarck Brown 2R* (TC) (C.I. 332) or *Manchester Brown EE.*

New Phosphine G (C) (C.I. 71) is a basic azo colour made from dimethyl-amino-benzylamine and resorcinol; if Beta-Naphthol is used in place of resorcinol Tannin Orange (C) (C.I. 72) is obtained.

The *Janus* dyes of the Hoechst Farbwerke belong to this class. *Janus Red B* (M) (C.I. 266) is made by coupling diazotised amino-phenyl-trimethylammonium chloride with *m*-toluidine. diazotising again and combining with Beta-naphthol.

If 1-naphthylamine is used as the second component and Chrysoidine as the third component, there is obtained *Janus Brown B* (C).

Acid Monazo Dyes

These dyes are formed, in general, by combining the diazo compound of an arylamine or its sulphonated derivative with aryl hydroxy or amino-compounds or their sulphonated derivatives.

The more important commercial dyes with their component intermediate products from which they are made are as follows:

Croceine Orange (TC) (C.I. 26)—aniline $\leftrightarrow$ 2-naphthol-6-sulphonic Acid
Orange G (TC) (C.I. 27) Aniline $\leftrightarrow$ 2-naphthol-6.8-disulphonic Acid

Chromotrope 2R (TC) (C.I. 29) aniline ↛ Chromotropic Acid
Fast Acid Fuchsine B (TC) (C.I. 30) aniline ↛ 1.8-amino naphthol-3.6-disulphonic Acid (H-Acid)
Amido Naphthol Red G (TC) (C.I. 31) aniline ↛ Acetyl-H-Acid
Chrome Yellow 2G (TC) (C.I. 36) *m*-nitraniline ↛ salicylic Acid
Chrome Yellow R (TC) (C.I. 40) *p*-nitraniline ↛ salicylic Acid
Victoria Violet (TC) (C.I. 53) *p*-phenylene diamine ↛ Chromotropic Acid
Lanafuchsine 6B (C.I. 54) *p*-amino-acetanilide ↛ 1-naphthol-3.6-disulphonic Acid
Chromotrope 6B (TC) (C.I. 56) *p*-amino-acetanilide ↛ Chromotropic Acid
Amido Naphthol Red 6B (TC) (C.I. 56) *p*-amino-acetanilide ↛ Acetyl-H-Acid
Sudan II (TC) (C.I. 73) xylidine ↛ 2-naphthol
Palatine Scarlet (C.I. 77) *m*-xylidine ↛ 1-naphthol-3.6-disulphonic Acid
Ponceau 2R (TC) (C.I. 79) *m*-xylidine ↛ 2-naphthol-3.6-disulphonic Acid
Ponceau 3R (TC) (C.I. 80) *ps*-cumidine ↛ 2-naphthol-3.6 disulphonic Acid
Bordeaux B (TC) (C.I. 88) 1-naphthylamine ↛ 2-naphthol-3.6-disulphonic Acid
Chromotrope 10B (C.I. 90) 1-naphthylamine ↛ Chromotropic Acid
Azo Eosine G (C.I. 114) *o*-anisidine ↛ 1-naphthol-4-sulphonic Acid (NW-Acid)
Azo Alizarine Yellow 6G (C.I. 122) *p*-phenetidine ↛ Salicylic Acid
Metanil Yellow (TC) (C.I. 138) Metanilic Acid ↛ diphenylamine
Methyl Orange (C.I. 141) Sulphanilic Acid ↛ dimethylaniline
Orange IV (C.I. 143) Sulphanilic Acid ↛ diphenylamine
Azo Yellow (TC) (C.I. 146) Nitrated Orange IV
Resorcine Yellow (TC) (C.I. 148) Sulphanilic Acid ↛ Resorcinol
Orange II (TC) (C.I. 151) Sulphanilic Acid ↛ β-naphthol
Lake Red P (C.I. 158) *o*-sulpho-*p*-nitraniline ↛ β-naphthol
Lake Red C (TC) (C.I. 165) 2-chlor-4-sulpho-5-toluidine ↛ β-naphthol
Fast Red A (TC) (C.I. 176) Naphthionic Acid ↛ β-naphthol
Azo Rubine (TC) (C.I. 179) Naphthionic Acid ↛ 1-naphthol-4-sulphonic Acid (NW Acid)
Amaranth (TC) (C.I. 184) Naphthionic Acid ↛ 2-naphthol-3.6-disulphonic Acid-R
Cochineal Red (TC) (C.I. 185) Naphthionic Acid ↛ 2-naphthol-6.8-disulphonic Acid-G
Lake Red R (TC) (C.I. 189) 2-Naphthylamine-1-sulphonic Acid ↛ β-naphthol
Mordant Yellow (TC) (C.I. 195) 2-Naphthylamine-6-sulphonic Acid ↛ Salicylic Acid
Fast Acid Blue R (TC) (C.I. 208) H-Acid ↛ Phenyl-1.8-naphthylamine-sulphonic Acid

Monazo colouring matters of recent introduction which have met with favour are the *Supramine* colours of Bayer, which are made by combining amino-diaryl ethers with aryl and alkyl derivatives of 2.8-amino naphthol-6-sulphonic Acid (Gamma Acid) [D.R.P. 221,491; E.P. 14,820/09; U.S.P. 953,033; 953,034; 953,035.] Other dyes of this class are made from various arylamines and nitroarylamines with the same Gamma Acid derivatives.

[D.R.P. 223,558; E.P. 10,462/09; U.S.P. 982,952; 982,953; 982,954.
D.R.P. 228,762; 228,763; E.P. 19,086/09.
D.R.P. 242,051; E.P. 369/10; U.S.P. 982,955.

D.R.P. 224,497; 220,532.]

Orange to red shades are made by combining the toluidine sulphonanilides with 2-naphthol-6-sulphonic Acid or Acetyl-2.5-amino-naphthol-7-sulphonic Acid.

[D.R.P. 230,594; E.P. 933/10; U.S.P. 989,954.]

[D.R.P. 235,775; E.P. 17,105/10; U.S.P. 1,005,233.]

Pigment dyes of great brilliancy and good fastness are made from the monazo combinations of aryl amines with Benzoyl-1.8-amino-naphthol-4.6-disulphonic Acid. These products are put on the market by Badische as the *Anthosine Reds*, also as Onis B, 3B, 5B.

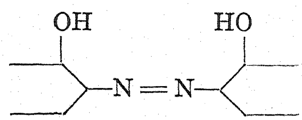
[D.R.P. 272,862 ;E.P. 15,147/12; U.S.P. 1,073,951.

D.R.P. 272,863; E.P. 15,146/12; U.S.P. 1,073,902; 1,073,903; 1,073,904.

D.R.P. 272,864; U.S.P. 1,073,905.]

Monazo Dyes from Ortho-aminophenols

The dyes made from *o*-aminophenols comprise the very valuable chrome or mordant colours of the azo group. Their value as chrome colours depends upon the ortho position of the hydroxyl group to the azo linkage, which enables a lake formation to take place when they are treated with a metallic salt.



All the important shades are produced by these combinations, with the possible exception of a pure red or scarlet. The following are some of the more important commercially valuable dyes made from ortho-aminophenol compounds:

Acid Chrome Brown B (TC) (C.I. 167) 2-aminophenol-4-sulphonic Acid ↛ *m*-phenylene diamine

Acid Chrome Garnet R (TC) (C.I. 168) 2-aminophenol-4-sulphonic Acid ↛ resorcinol

Chrome Violet B (TC) (C.I. 169) 2-aminophenol-4-sulphonic acid ↛ β-naphthol

Chrome Black PV (TC) (C.I. 170) 2-aminophenol-4-sulphonic Acid ↛ 1.5-di-hydroxy-naphthalene

Chrome Blue Black B (TC) (C.I. 201) 1.2-aminonaphthol-4-sulphonic Acid ↛ alpha-naphthol

Chrome Blue Black U (TC) (C.I. 202)-1.2-aminonaphthol-4-sulphonic Acid ↛ β-naphthol

Chrome Black T (TC) (C.I. 203)-1.2-aminonaphthol-5-nitro-4-sulphonic Acid ↛ 1-naphthol

Chrome Black A (TC) (C.I. 204)-1.2-aminonaphthol-5-nitro-4-sulphonic Acid ↛ β-naphthol

Chrome Red B (TC) (C.I. 216) Anthranilic Acid ↛ 2-naphthol-3.6-disulphonic Acid-R
Metachrome Brown B (C.I. 101) Picramic Acid ↛ *m*-toluylene diamine
Metachrome Olive Brown G (C.I. 104) Picramic Acid ↛ para-cresol

The dyestuffs made by using salicylic acid as the second component give mostly yellow shades and are valuable as mordant colours.

Chrome Yellow GG (TC) (C.I. 36) *m*-nitraniline ↛ Salicylic Acid
Chrome Yellow R (TC) (C.I. 40) *p*-nitraniline ↛ Salicylic Acid
Erio Chrome Yellow 6G (C.I. 122) *p*-phenetidine ↛ Salicylic Acid
Mordant Yellow (TC) (C.I. 195) 2-naphthylamine-6-sulphonic Acid ↛ Salicylic Acid
Eriochrome Phosphine R (C.I. 157) *p*-nitraniline-*o*-sulphonic acid ↛ Salicylic Acid
Diamond Yellow G (C.I. 218) *m*-aminobenzoic Acid ↛ Salicylic Acid

The Ice Colours

This group of dyes comprises colours which are developed on the fibre and cannot be applied in the ordinary way because they are insoluble products which do not contain sulphonic-acid groups. In general, they are used for dyeing and printing cotton, the fibre, being impregnated with a solution of a phenolic compound and the colour developed by passing through a solution of a diazo compound. The dyeings obtained have great brilliancy and fastness; in fact some of the shades produced with the arylamides of β-oxynaphthoic Acid are as fast as any colours known.

The products on the market for the production of these colours are mostly arylamines in either the base form or in the form of the stabilised diazo derivative. The fibre is impregnated with β-naphthol, and the diazotized base used for developing the colour.

As examples we may note:

Azophor Orange (C.I. 38) *m*-nitraniline
Para Red (C.I. 44) *p*-nitraniline
Paranil A (C.I. 44) Stabilised diazotised *p*-nitraniline
Nitro toluidine Orange (C.I. 68) *p*-nitro-*o*-toluidine
Nitro toluidine Base HR (C.I. 69) *m*-nitro-*p*-toluidine
Naphthylamine Claret (C.I. 82) 1-naphthylamine
Nitrosamine Pink BX (C.I. 117) *p*-nitro-*o*-anisidine

In recent years colours of this type have been developed by using, in place of β-naphthol, the arylamides of β-oxynaphthoic acid. A wider range of shades has been obtained, and their fastness is superior to the older ice colours. These colours are commonly spoken of as belonging to the Naphthol AS series, and there is a

great and increasing number of these products on the market which have been developed by the Griesheim-Elektron Ges.

Some of the more important arylamides of β-oxynaphthoic Acid in commercial use are as follows:

Naphthol AS............	anilide of β-oxynaphthoic Acid
Napthol AS-BS..........	*m*-nitroanilide of β-oxynaphthoic Acid
Naphthol AS-BO.........	1-naphthylide of β-oxynaphthoic Acid
Naphthol AS-RL.........	*p*-anisidide of β-oxynaphthoic Acid
Naphthol AS-BR.........	dianisidide of β-oxynaphthoic Acid
Naphthol AS-SW.........	β-naphthylide of β-oxynaphthoic Acid
Naphthol AS-G..........	diaceto acetic-tolidide.

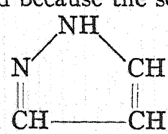
The bases used in conjunction with the Naphthol products are:

Fast Yellow G, GC.......	*o*-chloraniline
Fast Orange R...........	*m*-nitraniline
Fast Red G..............	*m*-nitro-*p*-toluidine
Fast Red 3 GL...........	*p*-chloro-*o*-nitraniline
Fast Red KB.............	*p*-chloro-*o*-toluidine
Fast Red R..............	*p*-chloro-*o*-anisidine
Fast Red RL.............	5-nitro-2-toluidine
Fast Red B..............	5-nitro-2-anisidine
Fast Scarlet G..........	*p*-nitro-*o*-toluidine
Fast Scarlet 2G.........	2.5-dichloraniline
Fast Scarlet R..........	*p*-nitro-*o*-anisidine
Fast Garnet B...........	1-naphthylamine
Fast Black LB...........	2-ethoxybenzene-azo-1-naphthylamine

Mixtures of the stabilised diazo compounds with the Naphthol AS products are on the market as the *Rapid Fast Colours* (Gr. E.). The fibre is first impregnated with an alkaline solution of the mixture and the colour subsequently developed by an acid treatment.

Pyrazolone Dyes

The Pyrazolone dyes are a sub-division of the azo dyes and are so called because the second components used are derivatives of pyrazole:



known as pyrazolones. These dyes give mostly yellow shades and are distinguished by their good fastness on wool.

The most important and oldest member is Tartrazine (TC) (C.I. 640) made from dioxytartaric Acid and phenylhydrazine-*p*-sulphonic Acid.

Other important dyes in this group are:

Fast Light Yellow 2G (TC) (C.I. 636) aniline + 1-*p*-sulphobenzene-3-methyl-5-pyrazolone
Xylene Yellow 3G (C.I. 639) *o*-sulphanilic acid + 1-(2.5-dichloro-4-sulphobenzene)-3-methyl-5-pyrazolone
Polar Yellow 5G (C.I. 642) Toluene-*p*-sulphonyl ether of *p*-amido phenol + 1-(4-chloro-2-sulphobenzene)-3-methyl-5-pyrazolone
Eriochrome Red B (C.I. 652) 1-amino-2-naphthol-4-sulphonic acid + 1-phenyl-3-methyl-pyrazolone

Mention should be made here of a class of azo dyes which are formed by coupling a diazo compound with aceto-acetic-aryl amides. Important pigment dyes, the *Hansa Yellows* of M. L. B., are made by combining a base, such as *p*-nitraniline, with acetoacetanilide.

[D.R.P. 257,488.
U.S.P. 1,082,719.]

Acid Disazo Dyes

The dyes of this group contain two azo groupings and conform to the general formula

$$R—N═N—R^1—N═N—R^2$$

wherein, R, R^1 and R^2 may be either benzene or naphthalene nuclei. In the red dyes of this group the nuclei R and R^1 are benzene derivatives, whilst with the black, blue and green dyes R^1 is always a naphthalene nuclei and R and R^2 may be either benzene or naphthalene.

Most of these dyes are acid colours for wool but a few are mordant colours. A sharp line of demarcation cannot be drawn between these dyes and those classified as "Direct Cotton Colours" because if certain naphthalene derivatives such as "J" Acid are used the colours have an affinity for cotton.

The following list gives some of the commercially valuable dyes in this group:

Resorcine Brown B (TC) (C.I. 234) Sulphanilic Acid → Resorcinol ← *m*-xylidine
Resorcine Dark Brown (TC) (C.I. 235)

1-Naphthylamine-4-sulphonic Acid ↘
Resorcinol
1-Naphthylamine-4-sulphonic Acid ↗

Acid Black 10B (TC) (C.I. 246) *p*-nitraniline → H-acid ← aniline
Brilliant Croceine (TC) (C.I. 252) amino-azobenzene → 2-naphthol-6.8-disulphonic Acid
Ponceau SS (TC) (C.I. 253) amino-azobenzene → 2-naphthol-3.6-disulphonic Acid
Cloth Red 3GX (C.I. 256) *o*-amino-azo-toluene → 2-naphthylamine-6-sulphonic Acid

Sudan IV (TC) (C.I. 258) *o*-amino azo toluene → β-naphthol
Cloth Red B (TC) (C.I. 259) *o*-amino azo toluene → 1-naphthol-4-sulphonic Acid
Cloth Red 2B (TC) (C.I. 262) *o*-amino azo toluene → 2-naphthol-3.6-disulphonic Acid
Cloth Scarlet G (TC) (C.I. 275) Aminoazobenzene sulphonic Acid → β-naphthol
Scarlet EC (TC) (C.I. 280) Aminoazobenzene disulphonic Acid → β-naphthol
Sulphon Cyanine G (C.I. 288) Aniline → Cleves acid → phenyl-1-naphthylamine-8-sulphonic Acid
Fast Cyanine 5R (TC) (C.I. 289) metanilic Acid → α-naphthylamine → *p*-tolyl-1-naphthylamine-8-sulpho acid
Acid Black 10B (TC) (C.I. 294) Sulphanilic Acid → α-naphthylamine → H-Acid
Chrome Black F (TC) (C.I. 299) Aminosalicylic Acid → α-naphthylamine → 1-naphthol-5-sulphonic Acid
Diamond Green B (C.I. 302) Aminosalicylic Acid → α-naphthylamine → 1.8-amino-naphthol-4-sulpho Acid
Fast Acid Black N2B (TC) (C.I. 304) *p*-aminodiphenylamine sulphonic Acid → α-naphthylamine → 1-naphthol-6-sulphonic Acid
Fast Acid Black F (TC) (C.I. 306) Naphthionic Acid → H-Acid → β-naphthol
Fast Cyanine Black B (TC) (C.I. 307) 1-naphthylamine-5-sulphonic Acid → α-naphthylamine → phenyl-1-naphthylamine-8-sulphonic Acid
Naphthylamine Black D (TC) (C.I. 308) 1-naphthylamine-3.6-disulphonic Acid → α-naphthylamine → α-naphthylamine
Naphthol Black 6B (C.I. 311) 1-naphthylamine-4.6-disulphonic acid → α-naphthylamine → 2-naphthol-3.6-disulphonic Acid
Acid Alizarine Black SE (C.I. 336) 2.6-diaminophenol-4-sulphonic Acid ↗ β-naphthol ↘ β-naphthol

Chrome Red S (C.I. 340)

p-phenylenediamine ↗ salicylic Acid ↘ 2-naphthylamine-6-sulphonic Acid

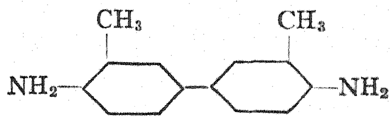
Substantive or Direct Cotton Dyes

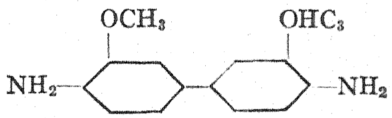
Since the discovery, in 1884, of the first direct dyeing colour for cotton, namely, Congo Red, there has been an ever increasing number of direct cotton dyes marketed. The tendency has been always to find dyes of greater fastness, so that the older and more fugitive colours are gradually replaced. With this development new intermediates have been pressed into service, and more complex combinations have been made. It has been found possible to link several azo groupings and thus obtain not only tris-azo dyes but tetrakisazo dyes and even combinations which contain five and six azo groupings. These poly-azo dyes are best suited for the dyeing of cotton.

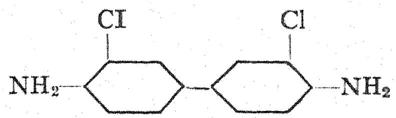
An examination of the composition of the direct cotton dyes reveals the almost general rule that the dye is made from a paradiamine; the nucleus may be a simple benzene or naphthalene one or it may be binuclear, that is, united with itself as in benzidine or by means of a group as in diamino-diphenyl urea.

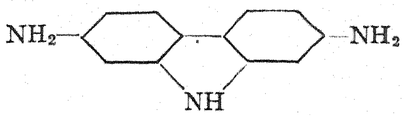
The following bases yield important substantive dyes:

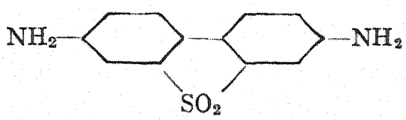
Benzidine


Tolidine


Dianisidine


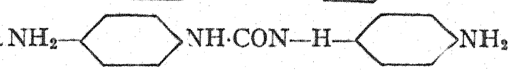
o-Dichlorobenzidine


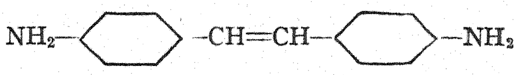
Diaminocarbazole


Benzidine Sulphone


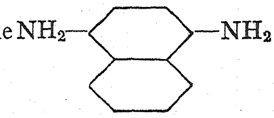
Diaminoazobenzene

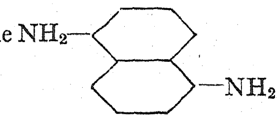

Diaminodiphenylamine


Diaminodiphenyl urea


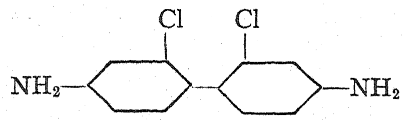
Diaminostilbene


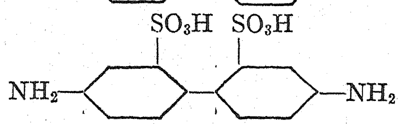
p-Phenylenediamine


1.4-Diamino-naphthalene 

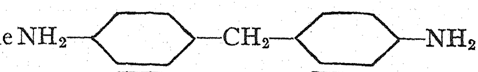
1.5-Diamino-naphthalene 

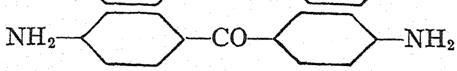
Exceptions to the general rule of direct dyes being made from bases of the above type are known. For example, derivatives of benzidine which have substituting groups meta to the amino group do not form dyes which have an affinity for cotton. Examples of such bases are:

m-Dichlorobenzidine 

Benzidine-*m*-disulphonic Acid 

Other para-diamines which do not form direct cotton dyes are:

Diamino-diphenylmethane 

Diamino-diphenylketone 

On the other hand, there are some bases which are not para-diamines, which form substantive or direct dyeing colours. Such are J-Acid or 2.5-amino-naphthol-7-sulphonic Acid and bases of the Primuline type, which are thiazole derivatives.

In order to facilitate the study of the "Direct Cotton Dyes" according to the bases from which they are derived it is found convenient to subdivide them into the following classes:

1. Dyes from Benzidine and other Binuclear Bases
2. Dyes from Aromatic Diamines.
3. J-Acid Dyes.
4. Thiazole Dyes.
5. Stilbene Dyes.

The following list gives the more important dyes derived from Benzidine and other binuclear Bases.

Congo Red (TC) (C.I. 370) Benzidine ↗ Naphthionic Acid
↘ Naphthionic Acid

Congo Corinth G (TC) (C.I. 375) Benzidine ↗ N. W. Acid
↘ Naphthionic Acid

Direct Scarlet B (TC) (C.I. 382) Benzidine ↗ Phenol (Ethylated after coupling)
↘ G-Acid

Bordeaux (TC) (C.I. 385) Benzidine ↗ 2-naphthol-8-sulpho Acid
↘ 2-naphthol-8-sulpho Acid

Direct Violet R (TC) (C.I. 387) Benzidine ↗ 2-Naphthol
↘ 1-Naphthol-3.6.8-trisulpho Acid

Direct Violet N (TC) (C.I. 394) Benzidine ↗ Gamma Acid (Acid coupling)
↘ Gamma Acid

Developed Black BHN (TC) (C.I. 401) Benzidine ↗ H-Acid
↘ Gamma Acid

Direct Blue 2B (TC) (C.I. 406) Benzidine ↗ H-Acid
↘ H-Acid

Chrysamine G (TC) (C.I. 410) Benzidine ↗ Salicylic Acid
↘ Salicylic Acid

Direct Orange R (TC) (C.I. 415) Benzidine ↗ Salicylic Acid
↘ 1-naphthylamine-4-sulpho Acid

Direct Fast Red F (TC) (C.I. 419) Benzidine ↗ Salicylic Acid
↘ Gamma Acid (Acid coupling)

Direct Brown M (TC) (C.I. 420) Benzidine ↗ Salicylic Acid
↘ Gamma Acid (Alkaline coupling)

Diphenyl Brown BN (C.I. 422) Benzidine ↗ Salicylic Acid
↘ Dimethyl-Gamma Acid

Polar Red G (C.I. 430) Benzidine ↗ G-Acid
↘ Phenol-*p*-toluol sulpho-ester

Benzopurpurine 4B (TC) (C.I. 448) Tolidine ↗ Naphthionic Acid
↘ Naphthionic Acid

Congo Orange R (C.I. 459) Tolidine ↗ 2-naphthylamine-3.6-disulpho Acid
↘ Phenol (Ethylated)

Direct Blue R (TC) (C.I. 464) Tolidine	↗ 2-naphthol ↘ 1-naphthol-3.6.8-trisulpho Acid
Direct Blue BX (TC) (C.I. 472) Tolidine	↗ H-Acid ↘ N. W. Acid
Direct Blue 3B (TC) (C.I. 477) Tolidine	↗ H-Acid ↘ H-Acid
Direct Orange G (TC) (C.I. 478) Tolidine	↗ *m*-toluylene diamine-sulpho Acid ↘ *o*-Cresotinic Acid
Benzopurpurine 10B (TC) (C.I. 495) Dianisidine	↗ Naphthionic Acid ↘ Naphthionic Acid
Direct Azurine G (TC) (C.I. 502) Dianisidine	↗ N. W. Acid ↘ N. W. Acid
Direct Blue RW (TC) (C.I. 512) Dianisidine	↗ 2-naphthol ↘ 1.8-amino naphthol-2.4-disulpho Acid.
Direct Pure Blue 6B (TC) (C.I. 518) Dianisidine	↗ 1.8-amino naphthol-2.4-disulpho Acid ↘ 1.8-amino naphthol-2.4-disulpho Acid
Direct Pure Blue (TC) (C.I. 520) Dianisidine	↗ H-Acid ↘ H-Acid
Direct Black EW (TC) (C.I. 581) Benzidine	↗ H-Acid ← Aniline ↘ *m*-phenylene-diamine
Direct Black RX (TC) (C.I. 582) Benzidine	↗ H-Acid ← Aniline ↘ *m*-toluylene diamine
Direct Green ET (TC) (C.I. 583) Benzidine	↗ H-Acid ← aniline (acid coupling) ↘ Phenol
Direct Green B (TC) (C.I. 593) Benzidine	↗ H-Acid ← *p*-nitraniline ↘ Phenol
Direct Brown 3GO (TC) (C.I. 596) Benzidine	↗ *m*-phenylene diamine → sulphanilic Acid ↘ Salicylic Acid
Chlorazol Fast Yellow 5GK (C.I. 346) *p-p*-Diamino-diphenyl urea	↗ Salicylic Acid ↘ Salicylic Acid

Para Fast Brown GR (C.I. 352) *p-p*-Diamino-*m.m*-disulpho diphenyl urea $\nearrow$ *m*-phenylene-diamine; $\searrow$ *m*-phenylene-diamine

Direct Fast Pink 2 BL/(TC) (C.I. 353) *p-p*-Diamino-*m.m*-disulpho diphenyl urea $\nearrow$ Gamma Acid; $\searrow$ Gamma Acid

Chrysophenine G (TC) (C.I. 365) 4.4-diamino stilbene-2.2-disulphonic Acid $\nearrow$ phenol (Ethylated); $\searrow$ phenol (Ethylated)

Pluto Black 5 BS Ex. (C.I. 544) *p-p*-diamino-diphenylamine $\nearrow$ *m*-phenylene-diamine; $\searrow$ Gamma Acid → Gamma Acid

Direct Cotton Dyes Derived from Diamines of the Benzene and Naphthalene Series

The following diamines are utilised for the production of direct cotton dyes:

p-Phenylene diamine, *m*-phenylene diamine, *m*-toluylene-diamine, 1.4-diamino-naphthalene and their sulphonic Acids.

Examples of commercial dyes prepared from one or more of these diamines are:

Diaminogen (TC) (C.I. 317) (Acetyl-) 1.4-diamino-naphthalene-7-sulphonic Acid → α-naphthylamine → Gamma Acid

Biebrich Patent Black BO (C.I. 320) α-naphthylamine-3.6-disulphonic Acid → Cleves Acid → R-Acid

Toluylene Orange RR (C.I. 335) β-naphthylamine ← 2.6-toluylene diamine-4-sulphonic Acid → β-naphthylamine

Para Black R (C.I. 339) *p*-phenylene diamine $\nearrow$ 1.8-amino naphthol-4.6-disulphonic Acid; $\searrow$ *m*-phenylene-diamine

Diazo Fast Green BL (C.I. 532) Amino-Cleves Acid → Cleves Acid → Gamma Acid → α-methyl ketol

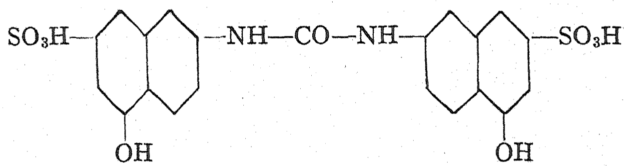
Benzo Fast Blue FR (C.I. 533) Aniline → Cleves Acid → Cleves Acid → J-Acid

Direct Brown G (TC) (C.I. 606)
Sulphanilic Acid $\searrow$ *m*-phenylene-diamine $\swarrow$ *m*-phenylene-diamine
m-phenylene-diamine $\searrow$ *m*-phenylene-diamine $\swarrow$ Sulphanilic Acid

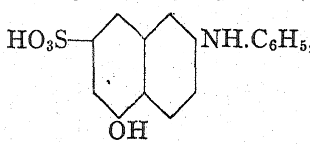
Direct Cotton Dyes Derived from J-Acid and Its Derivatives

J-Acid or 2-amino-5-naphthol-7-sulphonic acid and certain of its derivatives impart usually a substantive character to the dyes made by using it as one of the components.

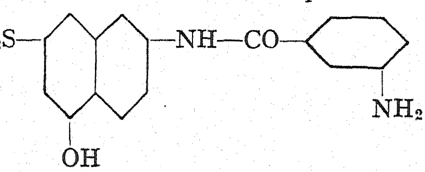
Derivatives of J-Acid which may be mentioned are the urea formed by the action of phosgene on J-Acid:



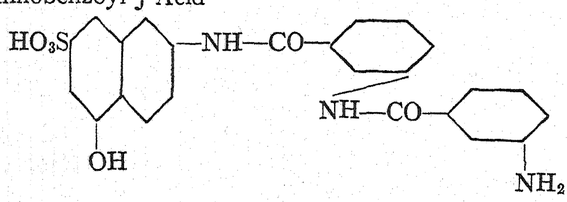
The *Benzo Fast Scarlets* (By) are made by coupling diazo compounds with this urea derivative.

2-Arylamino and 2-acylamino-5-naphthol-7-sulphonic acids, such as phenyl-J-Acid  are used as end components in dyes of the class of *Brilliant Benzo Fast Violet* (By), whilst J-Acid itself is used as an end component in the trisazo dyes of the type of Benzo Fast Blue FR (By).

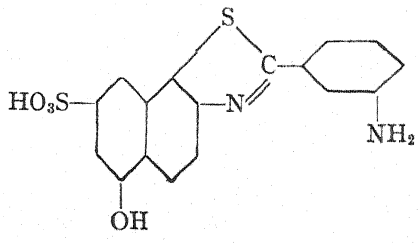
By the use of amino-benzoyl-J-Acid as end component direct colours are produced which can be diazotised and developed.

m-Amino benzoyl-J-Acid- 

is used for making the Rosanthrenes (Ciba), while *m*-aminobenzoyl-*m*-aminobenzoyl-J-Acid—



and thiazole derivatives of the type



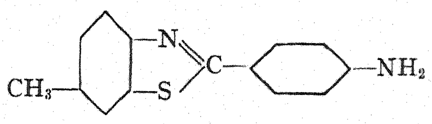
are used for the production of the Diazo Brilliant Scarlets (By).

The following are some examples of commercial dyes made with J-Acid derivatives—

Benzo Fast Scarlet 4BS (C.I. 327) Aniline → J-Acid-Urea ← *p*-amino-acetanilide
Brilliant Benzo Fast Violet BL (C.I. 319) H-Acid → α-naphthylamine → phenyl-J-Acid
Rosanthrene O (C.I. 324a) Aniline → *m*-aminobenzoyl-J-Acid
Diazo Brilliant Scarlet BG (C.I. 324) *o*-anisidine → *m*-aminobenzoyl-*m*-aminobenzoyl-J-Acid

Dyes from Thiazole Bases

When *p*-toluidine or *m*-xylidine are heated with sulphur under certain conditions thiazole bases are formed. The simplest derivative which is obtained has the formula



and is generally known as dehydrothio-*p*-toluidine. At a higher temperature a more complex product is formed containing several thiazole groups. Sulphonation of this product gives the commercial dye *Primuline*, which dyes cotton yellow and can be diazotised and developed on the fibre to give red, Bordeaux and brown shades.

Other commercial dyes derived from the thiazole bases are as follows:

Direct Pink (TC) (C.I. 128) Dehydrothio-*p*-toluidine → 1-naphthol-8-chlor-3.6-disulphonic acid
Erica B (C.I. 130) Dehydro-thio-*m*-xylidine → 1-naphthol-3.8-disulphonic Acid
Direct Pink R (TC) (C.I. 225) Dehydrothio-*p*-toluidine sulphonic acid → 1-naphthol-4-sulphonic Acid
Direct Scarlet SG (TC) (C.I. 227) Primuline → 1-naphthol-4-sulphonic Acid
Direct Scarlet G (TC) (C.I. 228) Primuline → 2-naphthol-6-sulphonic Acid

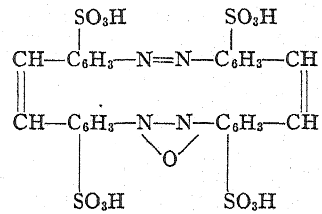
The Stilbene Dyes

By the action of sodium hydroxide solutions on *p*-nitrotoluene-*o*-sulphonic Acid certain stilbene derivatives are obtained which have direct dyeing properties.

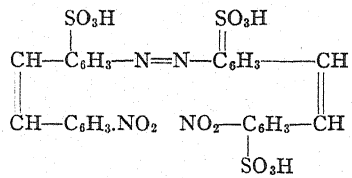
Three types of products are formed, depending upon the conditions of the sodium hydroxide treatment.

These types are exemplified by the following commercial dyes:

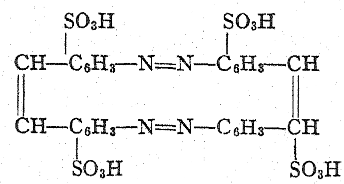
Direct Yellow R (TC) (C.I. 620) consisting mainly of Azoxy-azo-distilbene-tetra-sulphonic Acid—



Stilbene Yellow (TC) (C.I. 622) mainly dinitro-azo-distilbene-tetrasulphonic Acid—



Chloramine Orange G (TC) (C.I. 621) mainly Disazo-distilbene-tetrasulphonic Acid—



4.4′-Diamino stilbene-2.2′-disulphonic Acid is used for coupling with phenols and bases to form azo dyes. An example is *Chrysophenine G* which has been mentioned under "Dyes from Binuclear Bases."

Azo dyes containing the stilbene nucleus are also made by condensing intermediate products formed by the action of sodium hydroxide on *p*-nitro-toluene-*o*-sulphonic with amines or amino-azo-substances. *Diamine Fast Orange ER* (C) is so formed by condensing 4.4-dinitro-stilbene-2.2′ -disulphonic Acid with 4-sulpho-

benzene-azo-α-naphthylamine. (A.P. 903,284; E.P. 19,807 of Sept. 4, 1907; G.P. 204,212.)

The Carbonium Colouring Matters

The dyestuffs belonging to this class may be sub-divided into the following groups:

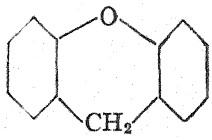
1. Ketonimine Dyes
2. Triarylmethane Dyes
3. Xanthene Dyes

The Ketonimine and Triarylmethane dyes may be considered to be aryl derivatives of methane,

$$H-\overset{\displaystyle H}{\underset{\displaystyle H}{\overset{|}{\underset{|}{C}}}}-H,$$

of which two or three of the hydrogen atoms are replaced with aryl residues.

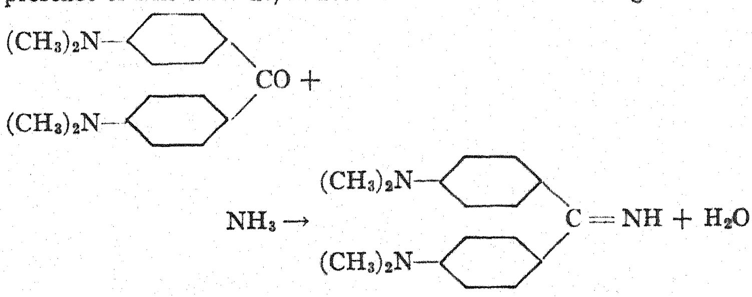
The Xanthene dyes are derivatives of Xanthene:



a substance which may be regarded as the ether of 2.2′-dihydroxy-diphenylmethane.

1. Ketonimines

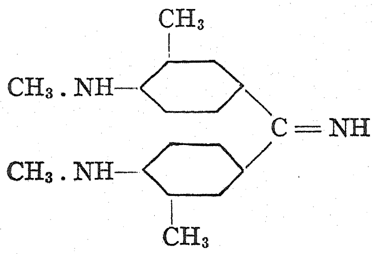
The ketonimines form a small group of dyes of which *Auramine* is the only important example. It is formed by the action of ammonium chloride on tetramethyldiaminobenzophenone in the presence of zinc chloride, in accordance with the following reaction:



Auramine Base

Auramine may also be prepared by heating tetramethyl diamino-diphenyl-methane with sulphur, ammonium chloride, salt and ammonia gas. The intermediate product, tetramethyl diamino-diphenyl-thioketone, is formed in this process.

A more greenish-yellow dye, *Auramine* G, is prepared from sym-dimethyl-diamino-*o*-ditolylmethane, and has the constitution.



2. Triarylmethane Dyes

The members of this class of dyes comprise the most brilliant shades and have the greatest tinctorial power of any class of colouring matters. On the other hand, their fastness properties leave much to be desired, but they nevertheless find extensive use for certain requirements.

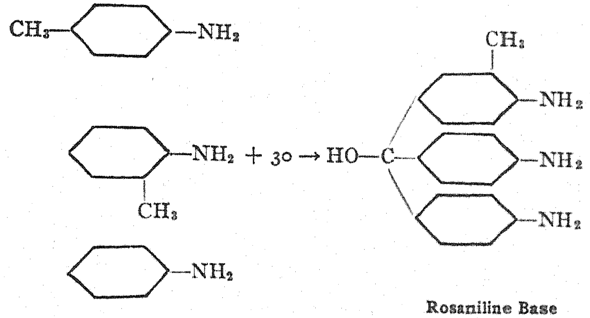
This class may be sub-divided according to the following convenient groups which serve to facilitate the study of the processes by which these dyes are made:

1. Triphenylmethane Dyes
   - A. Diamino Derivatives
   - B. Triamino Derivatives
   - C. Amino-oxy-Derivatives
   - D. Oxy-Derivatives
2. Diphenylnaphthylmethane Dyes

The most important methods for the preparation of the commercially valuable dyes of this class are as follows:

1. By the oxidation of para-arylamines, such as *p*-toluidine, together with bases of the class of aniline which have the para position to the amino group free. Nitrobenzene or arsenic acid are used as oxidising agents.

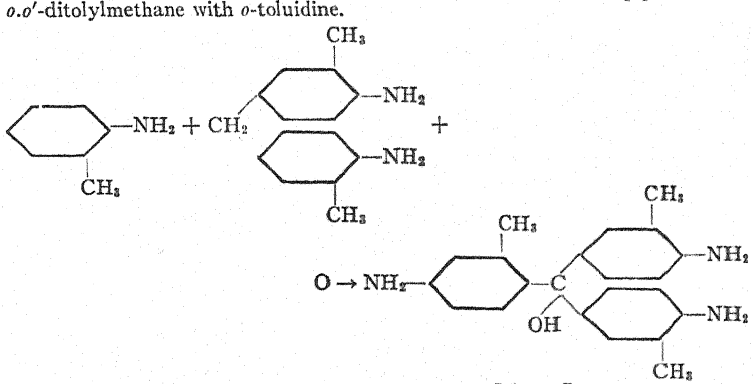
Magenta (TC) (C.I. 677) is prepared in this way from *p*-toluidine, *o*-toluidine and aniline.



Rosaniline Base

2. The oxidation of an arylamine with p-p'-diamino-diphenyl-methane or its derivatives.

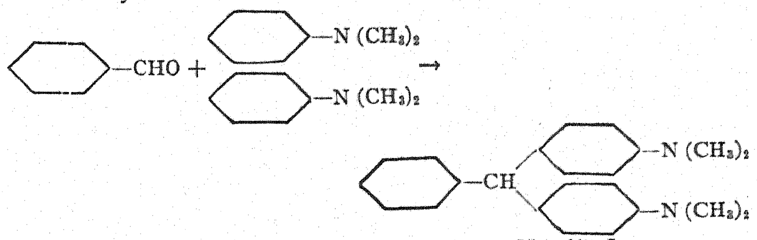
New Magenta (C.I. 678) is made in this way by the oxidation of p-p'-diamino-$o.o'$-ditolylmethane with o-toluidine.



Colour Base

3. The Condensation of aryl-aldehydes as benzaldehyde with two molecules of an aromatic base, in the presence of a condensing agent such as zinc chloride.

Malachite Green (TC) (C.I. 657) is made by the condensation of benzaldehyde with dimethylaniline in this manner:



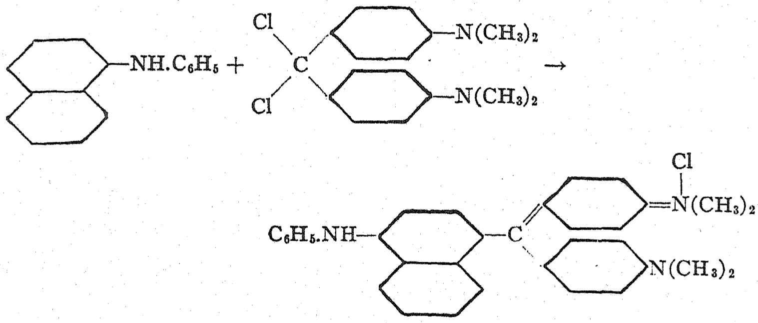
Leuco Base of Malachite Green

Aryl aldehydes may also be condensed with *o*-hydroxy-benzoic acid derivatives having the para position to the hydroxyl group free.

In this way *Eriochrome Cyanine* R (C.I. 722) is obtained from benzaldehyde-*o*-sulphonic acid and *o*-cresotinic acid with subsequent oxidation.

4. *Phosgene Process.*—By the condensation of benzophenone derivatives, formed by the action of phosgene on di-alkylated aryl-amines, with aromatic bases.

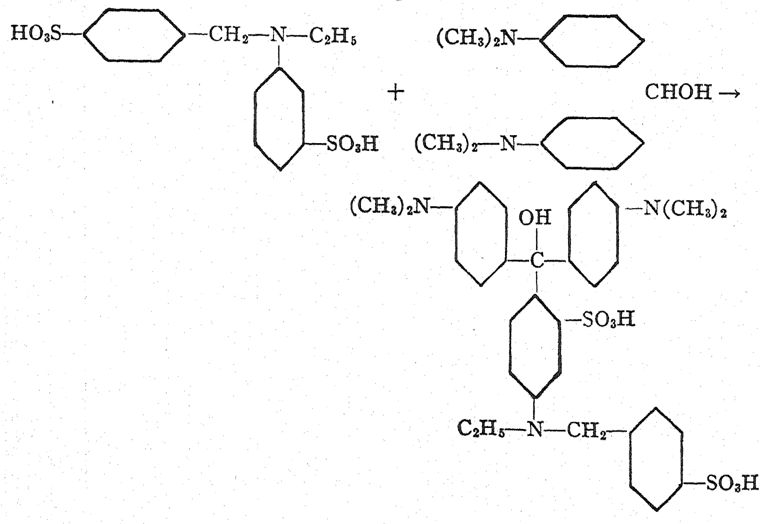
Victoria Blue B (TC) (C.I. 729) is formed in this way from tetramethyl diaminobenzophenone chloride and phenyl-α-naphthylamine:



Victoria Blue B

5. The Condensation of tetralkylated-diaminobenzhydrol and its analogues with aryl bases, phenols and their sulphonic acids.

Fast Acid Violet 10*B* (TC) (C.I. 696) is prepared from tetramethyl-diamino-benzhydrol and ethyl-benzyl aniline-disulphonic acid.



Other commercially valuable dyes of the Triarylmethane Series are classified as follows:

DIAMINO DERIVATIVES

Brilliant Green (TC) (C.I. 662) by condensing benzaldehyde with diethylaniline.

Acid Green B (TC) (C.I. 666) by condensing benzaldehyde with ethyl-benzylaniline-sulphonic acid.

Erioglaucine A (C.I. 671) by condensing benzaldehyde-*o*-sulphonic with ethylbenzylaniline-sulphonic acid.

Xylene Blue VS (C.I. 672) by condensing benzaldehyde-disulphonic acid with diethylaniline.

TRIAMINO DERIVATIVES

Methyl Violet (TC) (C.I. 680), a mixture of tetra-, penta-, and hexamethyl-*p*-rosanilines made by the oxidation of dimethylaniline with copper chloride.

Crystal Violet (TC) (C.I. 681) Condensation of tetramethyl-diaminobenzophenone chloride with dimethylaniline.

Spirit Blue (TC) (C.I. 689) Phenylation of Magenta by heating with aniline.

Acid Magenta (TC) (C.I. 692) Sulphonation of Magenta to di- and trisulphonic acids.

Fast Acid Violet 10B (TC) (C.I. 696) Condensation of tetramethyldiaminobenzhydrol with ethyl-benzylaniline-disulphonic acid.

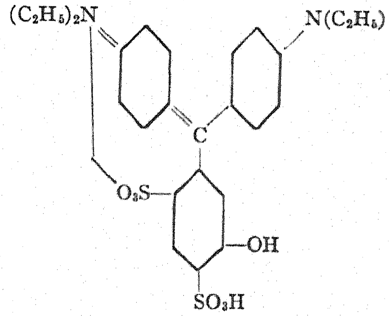
Acid Violet (TC) (C.I. 698) Condensation of *p*-*p'*-diethyl-*p.p'*-dibenzyl diaminobenzhydrol-di-sulphonic acid with diethylaniline.

Alkali Blue (TC) (C.I. 704) Sulphonation of Spirit Blue to the mono-sulphonic acid.

Soluble Blue (TC) (C.I. 707) Sulphonation of Spirit Blue to the di- and trisulphonic acids.

AMINO-OXY-DERIVATIVES

Patent Blue (TC) (C.I. 712). Condensation of *m*-hydroxy-benzaldehyde with diethylaniline with subsequent sulphonation and oxidation. It is most probably the calcium salt of the following:



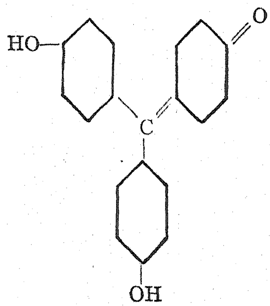
Patent Blue A (TC) (C.I. 714) is made with ethylbenzylaniline instead of diethylaniline.

Cyanol FF (C.I. 715) Condensation of *m*-hydroxy-benzaldehyde with mono-ethyl-*o*-toluidine and subsequent sulphonation and oxidation.

Oxy-derivatives

Eriochrome Azurol B (C.I 720). Condensation of dichlorbenzaldehyde with *o*-cresotinic acid.

Aurine (C.I. 724). By the action of oxalic acid on phenol in the presence of sulphuric acid; it has the formula:



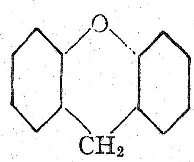
Diphenyl-naphthyl Methane Dyes

Victoria Blue B (TC) (C.I. 729). Condensation of tetramethyl diaminobenzhydrol with phenyl-α-naphthylamine.

Wool Green S (TC) (C.I. 737). Condensation of tetramethyl diaminobenzhydrol with 2-naphthol 6.8-disulphonic acid.

3. Xanthene Dyes

The colouring matters belonging to this class may be considered to be derivatives of Xanthene:



These derivatives may be sub-divided into three important groups.

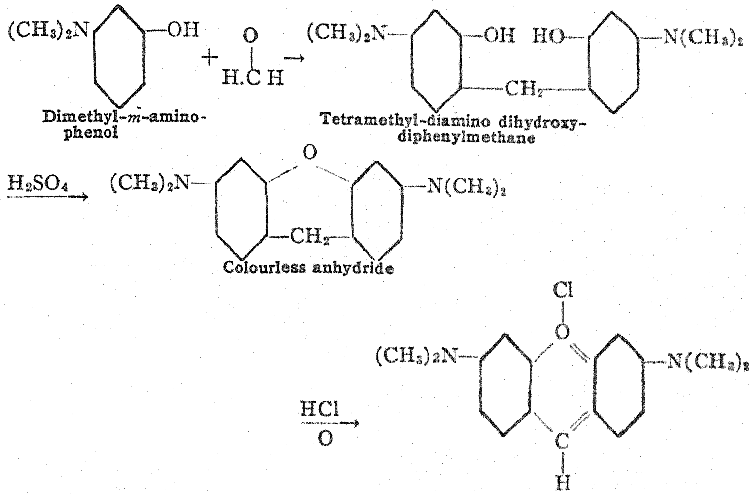
1. Amino Derivatives
2. Hydroxy Derivatives
3. Amino-hydroxy Derivatives

The amino-derivatives include several classes of dyes known as Pyronines, Succineines, Rosamines and Rhodamines.

The Hydroxy-derivatives of importance comprise the Phthaleins.

1. The Amino Derivatives

Pyronine G (C.I. 739) made by the condensation of formaldehyde with dimethyl-*m*-amino-phenol according to the following reactions:



Dimethyl-*m*-amino-phenol

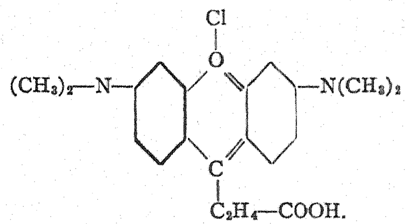
Tetramethyl-diamino dihydroxy-diphenylmethane

Colourless anhydride

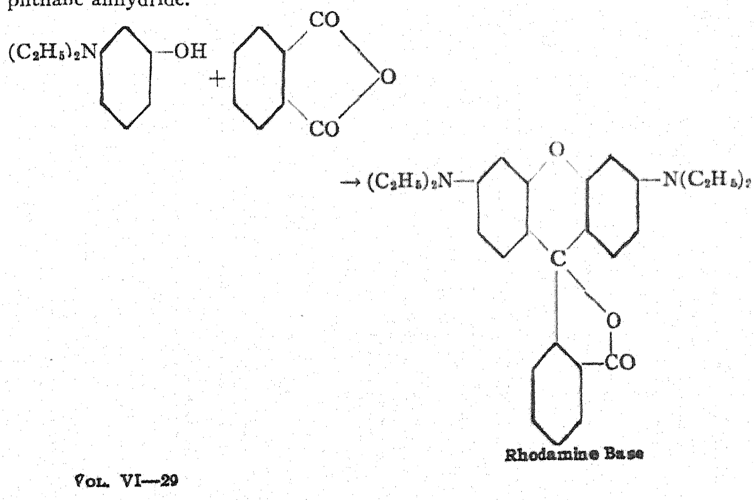
Pyronine G

Acridine Red 3B (C.I. 740) formed by the oxidation of Pyronine G with potassium permanganate.

Rhodamine S (C.I. 743). Condensation of dimethyl-*m*-aminophenol with succinic anhydride and has the formula:

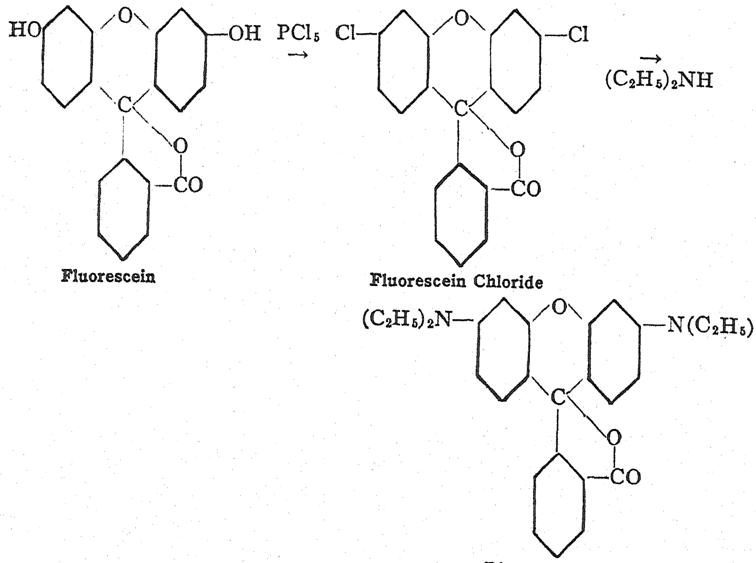


Rhodamine B (TC) (C.I. 749). Condensation of diethyl-*m*-aminophenol with phthalic anhydride.



Rhodamine Base

Rhodamine B may also be prepared from Fluorescein according to the following scheme of reactions:



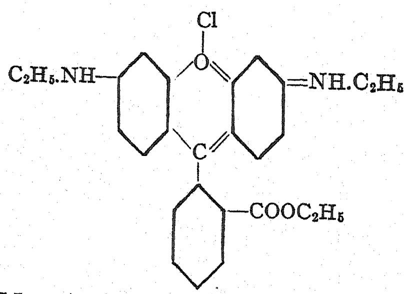
Fluorescein

Fluorescein Chloride

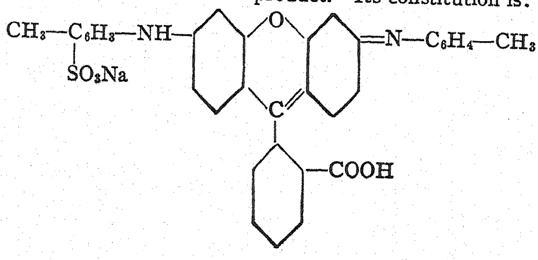
Rhodamine Base

Sulpho Rhodamine B (C.I. 748). Condensation of benzaldehydedisulphonic acid with diethyl-*m*-amino-phenol and oxidation.

Rhodamine 6G (TC) (C.I. 752). Condensation of mono-ethyl-*m*-aminophenol with phthalic anhydride and esterification of the resulting product. It has the constitution·



Violamine R (C.I. 758) Condensation of Fluorescein chloride with *o*-toluidine and sulphonation of the reaction product. Its constitution is:

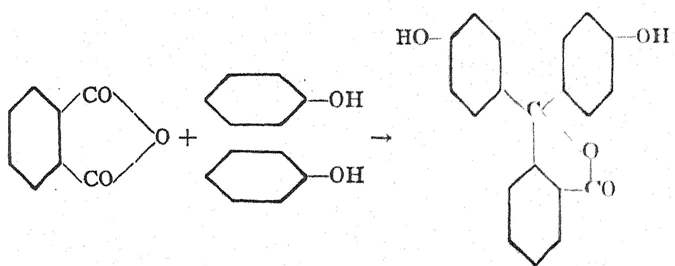


Violamine 3B (C.I. 760). Sulphonation of the condensation product from Fluorescein chloride and *p*-phenetidine.

2. The Hydroxy Derivatives

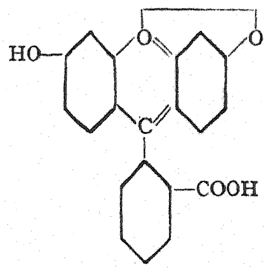
The hydroxy derivatives comprise the well known group of dyes known as the Phthaleins, which in general are formed by the condensation of phthalic anhydride with phenols.

The simplest member is Phenolphthalein produced by the condensation of phthalic anhydride with phenol as follows:

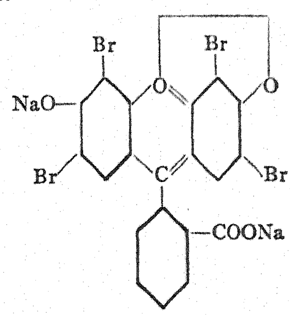


Phenolphthalein

Iranine (TC) (C.I. 766) or *Fluorescein*. Condensation of phthalic anhydride with resorcinol. It has the formula:



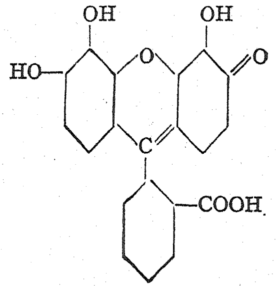
Eosine (TC) (C.I. 768). Bromination of Fluorescein to the tetra-brom product. It has the constitution:



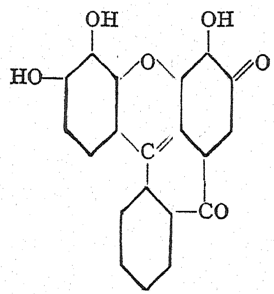
Erythrosine B (TC) (C.I. 773). Iodisation of Fluorescein to the tetra-iodo-derivative.

Rose Bengale G (C.I. 777). Iodisation to the tetra-derivative of the condensation product of dichlorphthalic anhydride with resorcinol.

Gallein (C.I. 781) Condensation of phthalic anhydride with gallic acid (pyrogallol). It has the constitution:



Coerulein (C.I. 783). Action of sulphuric acid on gallein, which eliminates water to form an anthraquinone derivative and which also contains a Xanthene complex. It has the constitution:

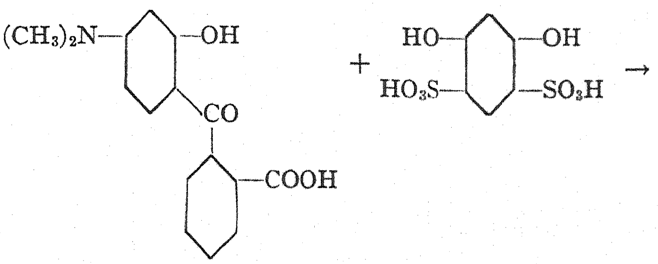


3. The Amino-hydroxy Derivatives. (Rhodols)

These compounds are intermediate between the fluoresceins and the rhodamines, as they contain the amino group on one side of the xanthene complex and a hydroxyl group on the other.

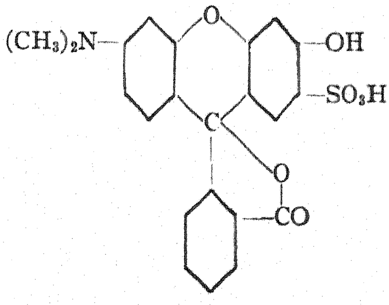
The *Chromorhodines* (DH) are representatives of this class and are produced by the condensation of dialkylamino-*m*-oxybenzoylbenzoic acids with resorcinol-disulphonic acid. (A.P. 1,002,825; 1,003,257; 1,055,864; 1,055,885; E.P. 10,523 of 1911; G.P. 244,652; 244,653; 245,234.)

An example is as follows:



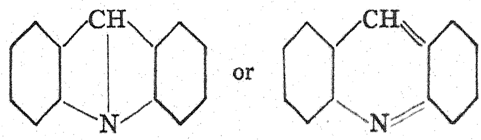
Dimethylamino-*m*-oxy-benzoyl benzoic acid

Resorcinol-disulphonic acid



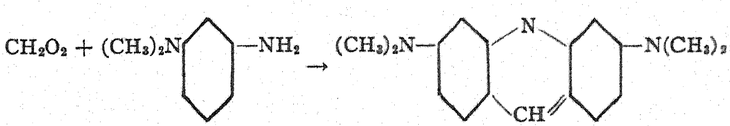
The Acridine Dyes

Acridine colouring matters are derivatives of a substance known as acridine, which has the formula:



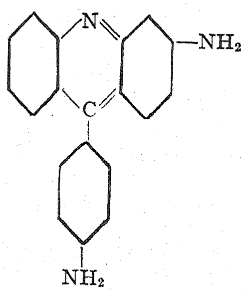
Commercially important dyes belonging to this class are as follows:

Acridine Orange NO (C.I. 788). Condensation of *m*-aminodimethylaniline with formic acid:



Acridine Orange

Phosphine (TC) (C.I. 793). One of the products formed in the magenta melt from the condensation of aniline and *p*-toluidine. It is the nitrate of the following base:

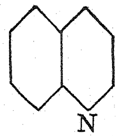


Rheonine A (C.I. 795). Condensation of tetramethyl-diaminobenzophenone with *m*-phenylene-diamine.

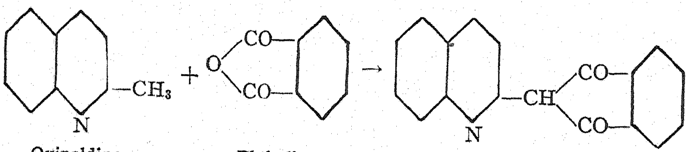
Certain acridine derivatives have been found to possess pronounced physiological action. Such derivatives are on the market as *Acriflavine* and *Proflavine.* Acriflavine is 3.6-diaminomethylacridinium chloride, made by the methylation of the condensation product obtained from, 4.4′-diamino-3.3′-dinitro-diphenylmethane.

The Quinoline Dyes

Dyes of this class are prepared from derivatives of the coal-tar base quinoline:



Quinoline Yellow, Spirit Soluble (C.I. 800). Condensation of phthalic anhydride with quinaldine, according to the following reaction:



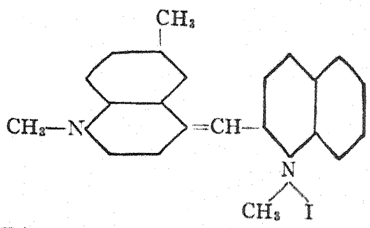
Quinoline Yellow (TC) (C.I. 801). Sulphonation of Quinoline Yellow, Spirit Soluble, to a mixture of mono- and di-sulphonic acids.

Quinoline Yellow KT Extra (By). Sulphonation of the condensation product from *p*-chloraniline with phthalic anhydride.

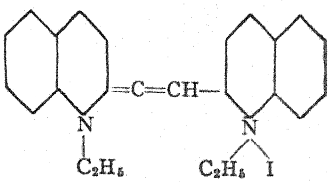
Certain complex quinoline derivatives are known for their lack of fastness, but they are of great value in photography where they are used for colour-sensitising photographic plates.

Examples of these products are:

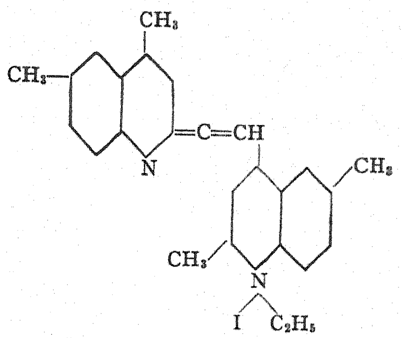
Pinaverdol (M.L.B.) has the formula:



Pinacyanol (M.L.B.) or Sensitol Red has the constitution:

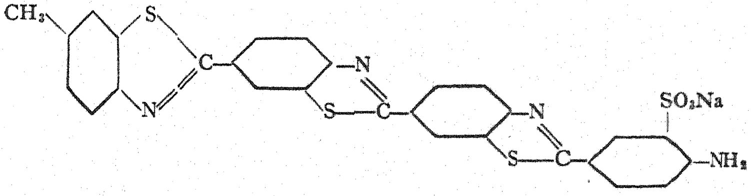


Dicyanine (M.L.B.) is probably:



The Thiazole Dyes

In the section on Azo dyes and under the sub-heading "Dyes from Thiazole Bases" mention was made of the formation of Primuline (TC) (C.I. 812) by the sulphonation of the condensation product made by heating *p*-toluidine with sulphur. Primuline consists largely of the following thiazole derivative:



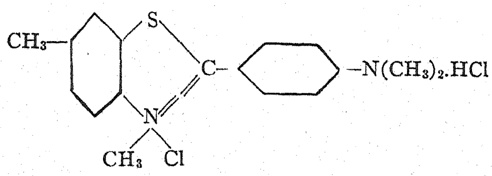
It dyes cotton yellow, which may be diazotised and developed on the fibre. The developers used and the colours they give are as follows:

Phenol	orange
Resorcinol	orange
m-Phenylene-diamine	brown
β-Naphthol	red
Ethyl-β-naphthylamine	Bordeaux
Naphthol AS	Bordeaux-red
p-Aminodiphenylamine	olive-green
Amino-carbazole	brown

Direct Pure Yellow M (TC) (C.I. 813). Action of ammonia on the diazo compound of Primuline.

Direct Fast Yellow (TC) (C.I. 814). Oxidation of dehydro-thio-*p*-toluidine-sulphonic acid with hypochlorites.

Thioflavine T (C.I. 815). Methylation of dehydro-thio-*p*-toluidine to form the product having the following formula:

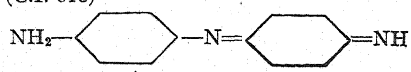


Indophenols and Indamines

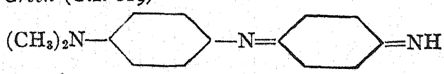
These products have no value as dyestuffs but are used as intermediate products for the manufacture of Azine, Thiazine and Sulphur Colouring Matters.

They are characterised by the quinone group, 

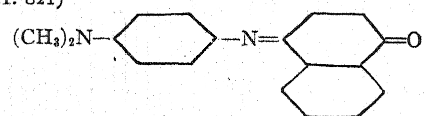
Phenylene Blue (C.I. 818)



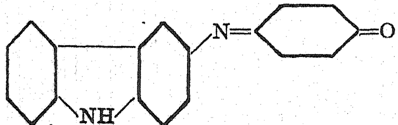
Bindschedler's Green (C.I. 819)



Indophenol (C.I. 821)



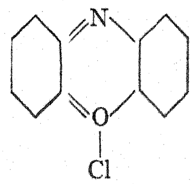
Carbazol Indophenol (C.I. 822)



The Oxazine Dyes

The oxazine dyes, together with the thiazines and azines, are derivatives of ortho-quinone. The best authorities regard these dyes as having an orthoquinoid nature rather than a para-quinoid one. They may also be considered as derivatives of diphenylamine.

The oxazines are characterised by the group:

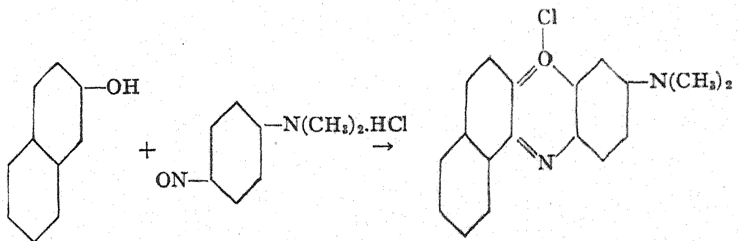


which is called Phenazoxonium Chloride.

The most important methods for making Oxazine dyes are as follows:

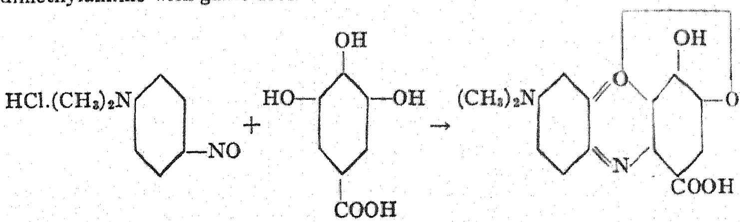
1. Condensation of a *p*-nitroso-dialkylamine with a phenol or phenolic compound.

In this manner *Cotton Blue* or Meldola's Blue (TC) (C.I. 909) is obtained from the hydrochloride of nitroso-dimethylaniline and β-naphthol:



β-naphthol **Cotton Blue**

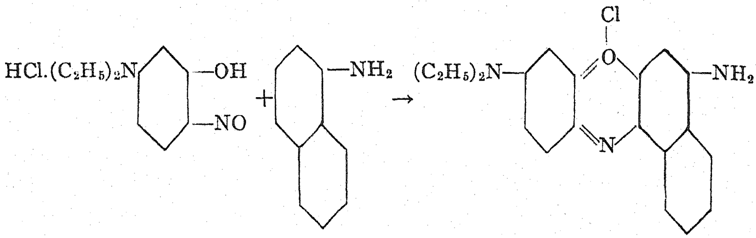
Gallocyanine (TC) (C.I. 883). Condensation of hydrochloride of nitroso-dimethylaniline with gallic acid.



Gallic Acid **Gallocyanine**

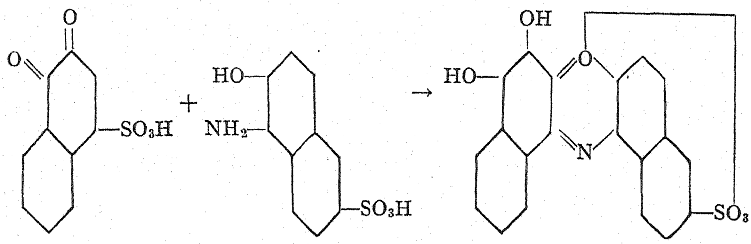
2. Condensation of *p*-nitroso-*m*-dialkyamino-phenols with amines.

Nile Blue A (C.I. 913) is made in this way from the hydrochloride of *p*-nitroso-*m*-diethylaminophenol and α-naphthylamine.



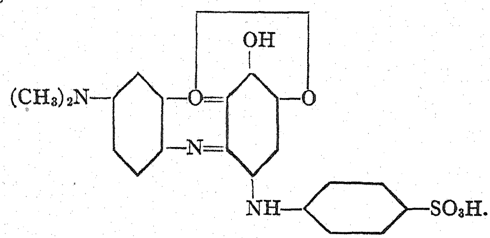
3. Condensation of β-naphthoquinone sulphonic acid with 1.2 or 2.1-amino naphthol sulphonic acids.

Alizarine Green G (C.I. 917) is so made from β-naphthoquinone-4-sulphonic acid and 1-amino-2-naphthol-6-sulphonic acid.



Other commercially important dyes of this class are as follows:

Delphine Blue B (TC) (C.I. 878). Condensation of Gallo-cyanine with aniline and sulphonation of the reaction product. The dye is the ammonium salt of the following:



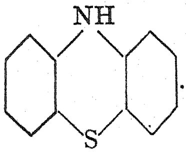
Anthracyanine BGG (C.I. 844). Action of *p*-amino-dimethyl-aniline on Gallocyanine and subsequent reduction of the reaction product.

Ultracyanine B (C.I. 892). Reduction of Gallamine Blue (C.I. 894).

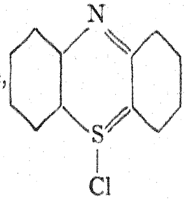
New Blue B (C.I. 910). Condensation of New Blue R with *p*-amino-dimethyl-aniline.

The Thiazine Dyes

The dyes of this class are derivatives of thio-diphenylamine,



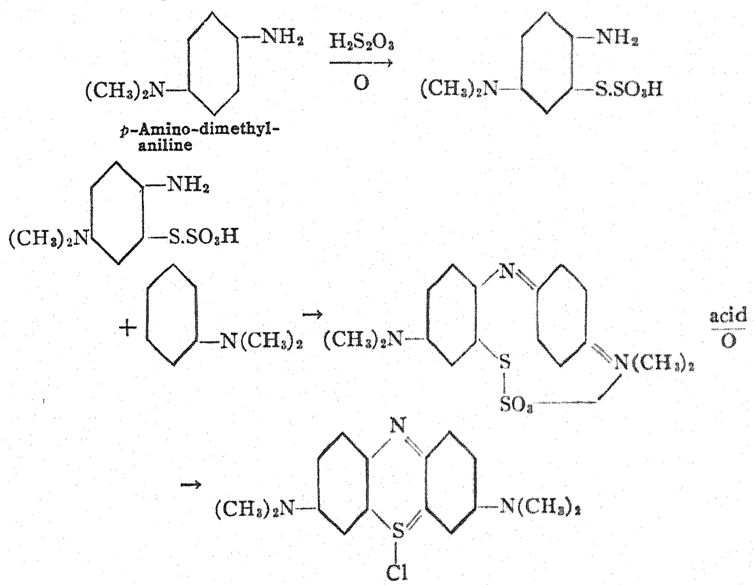
. The molecular complex which is present in the thiazine dyes is known as Phenazthionium chloride,



.

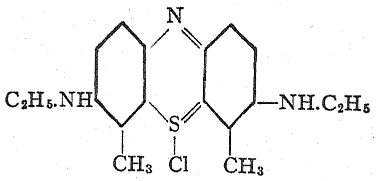
The technically important dyes of this group are as follows:

Methylene Blue (TC) (C.I. 922). *p*-Aminodimethylaniline is oxidised in the presence of a thiosulphate, and the reaction product is further oxidised with dimethylaniline to an indamine. The indamine is heated with acid and further oxidised to the dye. The reactions are as follows:

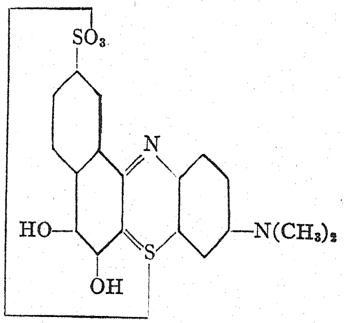


Methylene Blue

New Methylene Blue N (C.I. 927). *p*-Aminomonoethyl-*o*-toluidine is oxidised in the presence of thiosulphates, and the thiosulphonic acid so formed is further oxidised with monoethyl-*o*-toluidine. The formula for the dye is:

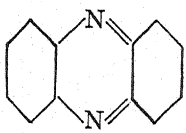


Brilliant Alizarine Blue R (C.I. 931). Condensation of β-naphthoquinone-disulphonic acid with *p*-amino-dimethylaniline in the presence of a thiosulphate. The constitution is represented as follows:

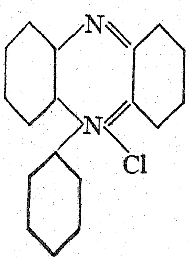


The Azine Dyes

The colouring matters in this class may be considered to be derivatives of Phenazine or diphenazine, which has the formula:



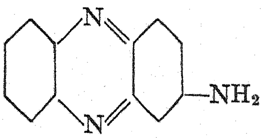
All of the commercially important dyes of the azine series, except the Eurhodines and Eurhodoles, are characterised by the molecular complex known as Phenylphenazonium chloride:



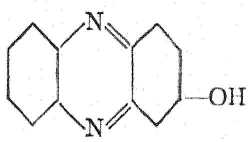
which, of course, is a derivative of Phenazine.

For convenience the Azine dyes may be sub-divided into the following classes which serve to group them according to their chemical constitution:

1. Eurhodines and Eurhodoles. These are, respectively, mono-amino phenazines and mono-hydroxy phenazines.

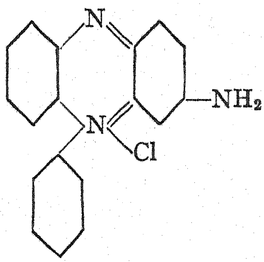


Eurhodine

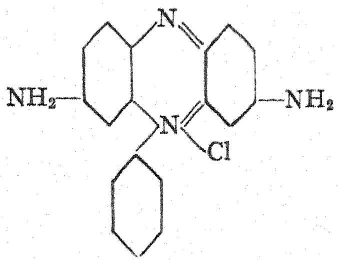


Eurhodole

2. Aposafranines and Safranines. The aposafranines are mono-amino derivatives of Phenylphenazonium chloride, whilst the Safranines are the diamino derivatives.

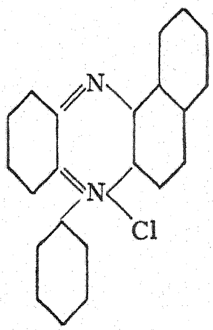


Aposafranine

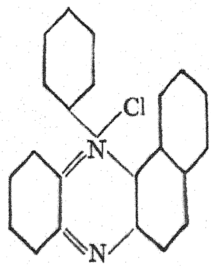


Safranine

3. Rosindulines and Isorosindulines. These are derivatives of the two possible Naphthophenazonium chlorides.

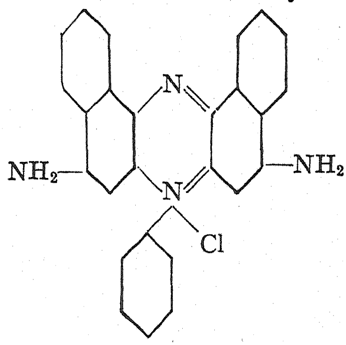


Phenylnaphthyl-
phenazonium chloride



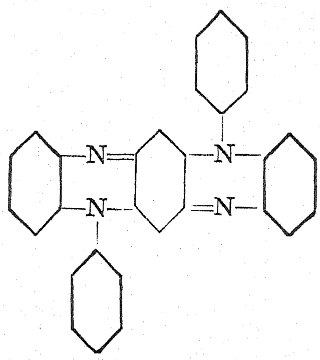
Isophenylnaphthyl-
phenazonium chloride

4. Naphthosafranines are characterised by the grouping:



5. Indulines and Nigrosines. The indulines are phenylated derivatives of tri- and tetra-amino-phenyl-phenazonium chloride.

Little is known of the constitution of the Nigrosines, but some of them contain varying amounts of Fluorindine:

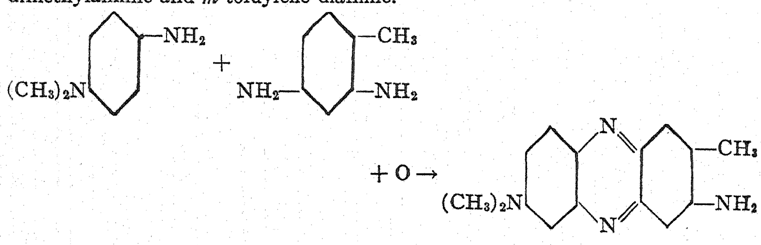


Azine dyes of the anthraquinone series will be discussed later in the section on the "Anthraquinone Dyes."

The commercially important colouring matters of the azine series, with the intermediates from which they are derived, are as follows:

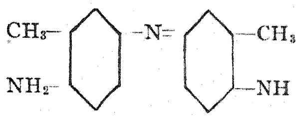
1. Eurhodines and Eurhodoles are of little technical value.

Neutral Red (C.I. 825). Made by the oxidation of a mixture of *p*-amino-dimethylaniline and *m*-toluylene-diamine.

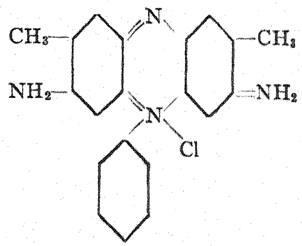


2. Aposafranines and Safranines.

Safranine (TC) (C.I. 841). Made by the oxidation of *p*-toluylene-diamine and *o*-toluidine to the indamine.

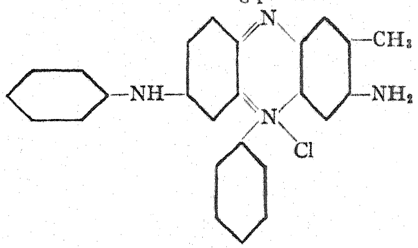


and condensation with aniline or *o*-toluidine to form the phenylphenazonium chloride derivative:

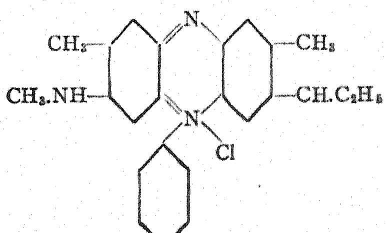


New Fast Grey (TC) (C.I. 873). By heating nitroso-dimethyl-aniline with water or alcohol. Constitution unknown.

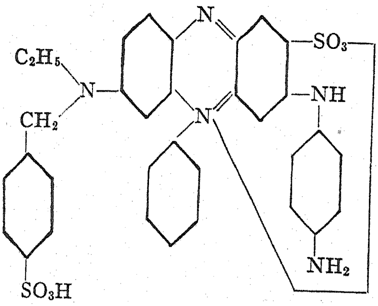
Rosolane O (C.I. 845). Oxidation of a mixture of *p*-amino-diphenylamine, *o*-toluidine and aniline to form the following product:



Brilliant Rhoduline Red B (C.I. 848). Action of *p*-nitroso-monomethyl-*o*-toluidine on phenyl-*p*-amino-monoethyl-*o*-toluidine to form methylamino-ethylamino-phenyl-ditolylazonium chloride:



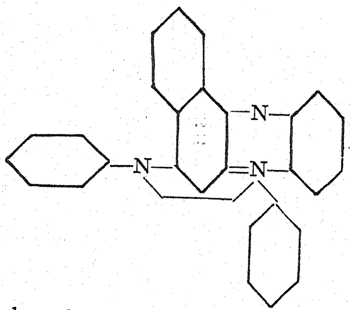
Acid Cyanine B, G (C.I. 853). These are Safranine Sulphonic Acids produced by condensing aniline with indamines produced from *p*-nitro or *p*-acetamino-*p*-amino-diphenylamine sulphonic acids with secondary or tertiary amines or their sulphonic acids. An example of a dye so produced is represented by the formula:



(A.P. 872, 815; G.P. 186, 597; 186, 598; 193, 472.)

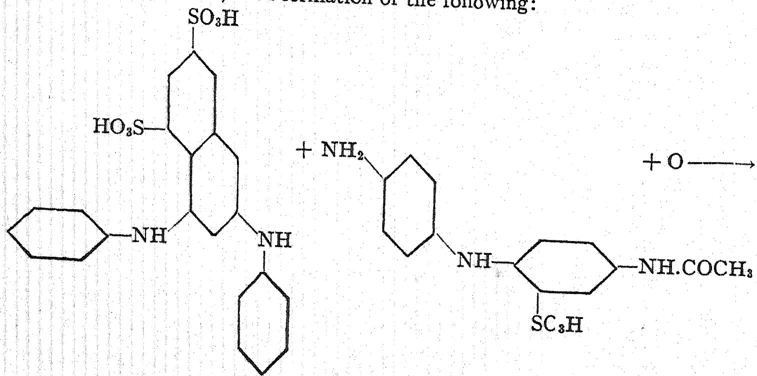
3. Rosindulines and Isorosindulines.

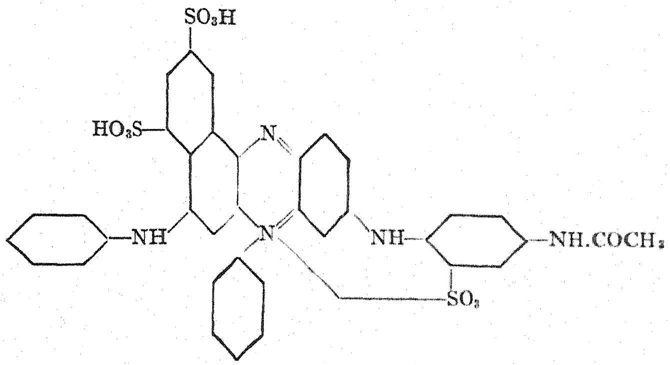
Azo Carmine G (C.I. 828). Condensation of benzene-azo-α-naphthylamine, aniline and aniline hydrochloride to form Phenylrosinduline: and subsequent sulphonation to the disulphonic acid.



Azo Carmine B (C.I. 829). Sulphonation of the above Phenylrosinduline to the tri-sulphonic acid.

Wool Fast Blue BL, GL (C.I. 833). By the oxidation of *p*-diamines with diaryl-1.3-naphthylenediamine sulphonic acids by means of air in the presence of ammoniacal copper oxide. The greenish shade is produced from diphenyl-1.3-naphthylenediamine-6.8-disulphonic acid and monoacetyl-*p*-*p*′-diaminodiphenylamine-*o*-sulphonic acid, with formation of the following:

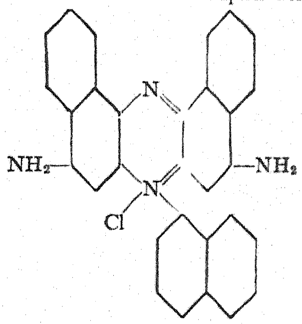




(A.P. 940, 354; E.P. 18,729 of 1928; G.P., 206, 646.)

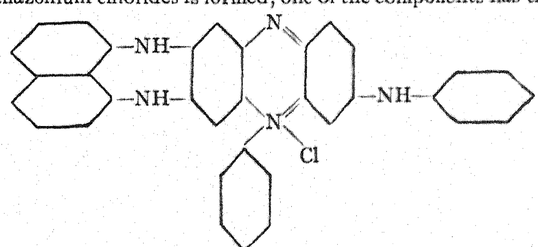
4. Naphthosafranines.

Magdala Red (C.I 857). Condensation and oxidation of α-naphthylamine, α-naphthylamine hydrochloride and aminoazonaphthalene. It has the formula:



5. Indulines and Nigrosines.

Induline: Spirit Soluble (TC) (C.I. 860). Condensation of aminoazobenzene with aniline and aniline hydrochloride. A mixture of phenylated polyaminophenyl-phenazonium chlorides is formed; one of the components has the formula:



Induline: Water Soluble (TC) (C.I. 861). Obtained by the sulphonation of Induline: Spirit Soluble.

Nigrosine: Spirit Soluble (TC) (C.I. 864). Heating a mixture of aniline, nitrobenzene and aniline hydrochloride with metallic iron. The constitution of

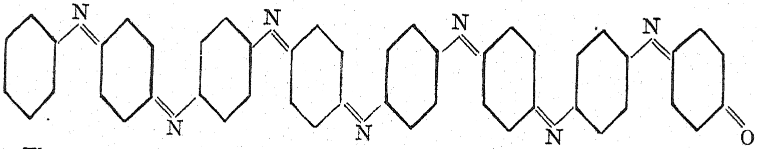
Nigrosine is more complex than that of Induline, but undoubtedly contains azine derivatives.

Nigrosine: Water Soluble (TC) (C.I. 865). Obtained by the sulphonation of Nigrosine: Water Soluble.

There are certain dyes formed on the fibre by oxidizing amino compounds. The colouring matters which are formed are without doubt complex azine or azonium compounds. These dyes are only made during their application and are therefore formed directly on the fibre. On account of their importance, and because the colouring matters are of the type of Azine products, it is advisable to discuss them in this section.

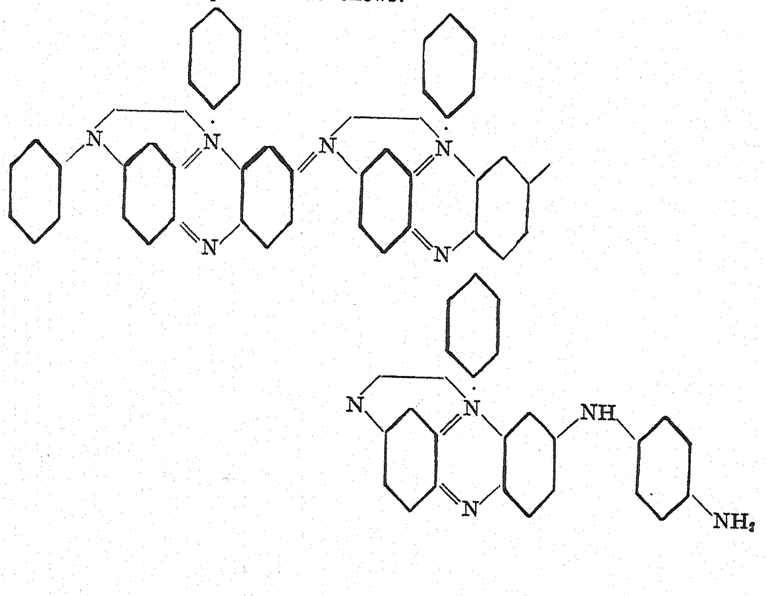
Aniline Black (TC) (C.I. 870). This is prepared by soaking the fibre in a solution of aniline hydrochloride, containing an oxidising agent, such as sodium chlorate, and an oxygen carrier, such as copper sulphate, vanadium chloride, etc. The impregnated fibre (cotton) is then dried, and the colour developed by hanging or steaming.

The oxidation of aniline to an ungreenable black apparently takes place with the formation of intermediate products. According to Willstätter (Ber. **42**, 2147; 4118 (1909); **43**, 2588; 2976; **44**, 2162 (1911) indamine-like products are formed, and he proposes the following formula for the "Ungreenable Aniline Black:"



The great resistance of Aniline Black to acids is not explained by this Indamine formula, so that further light has been thrown on the problem by Bucherer [Ber. (1907) **40**, 3412; (1909) **42**, 2931] and Green [Ber. (1911) **44**, 2570; **46**, 33 (1913); *Trans. Chem. Soc.* (1910) **97**, 2388; *Proc. Chem. Soc.* (1912) **28**, 250] who regard the "Ungreenable Aniline Black" as an aryl-azonium compound of high molecular weight formed during the oxidation process by the addition of several aniline groups to the Indamine molecule.

Their formula is represented as follows:



Ungreenable Aniline Black (Green)

Diphenyl Black (C.I. 871). *p*-Amino-diphenylamine is used in place of aniline and gives a direct ungreenable black.

Other amines are used for developing colours on fibres in a similar manner by oxidation. The dyes so produced are without doubt complex azine derivatives, but little is known of their constitution.

Some of these amines are extensively used for dyeing fur and hair and are placed upon the market for this purpose by the makers under various names.

Fur Black (TC) *Ursol D* (C.I. 875) is *p*-phenylenediamine.

Ursol P (C.I. 875) is *p*-aminophenol.

Fuscamine is *m*-aminophenol.

Ursol DD is *p.p*-diamino-diphenylamine.

Ursol A, *SA* is a mixture of *p*-phenylenediamine and *m*-diamino anisole.

(A.P. 992,947; E.P. 5134 of 1910; G.P. 226,790.)

(A.P. 1,105,554; 1,144,325.)

Ursol 4*G*, 6*G* are nitro-*m*-diaminoanisole (A.P. 1,105, 447; G.P. 255,858) and nitro-*m*-toluylene diamine.

Ursol Grey G is *p*-dimethylamino-*p*'-aminodiphenylamine.

(A.P. 1,183,748; G.P. 281,352.)

The Sulphur Dyes

The colouring matters belonging to this group include a number of important and widely known dyes. They are applied chiefly to cotton and in regard to fastness lie intermediate between the direct azo colours and the vat colours. Less is known of the chemical constitution of the sulphur dyes than of any other class of synthetic colouring matters. In general, they are prepared by the action of sulphur and sodium sulphide on amines, aromatic nitro compounds, indamines or indophenols.

It is a well established fact that the sulphur treatment or fusion as it is usually spoken of, introduces mercaptan groups (—SH) into the molecule. Where it is possible ring formation may occur leading to the production of thiodiphenylamine, thiazine, thiazole or other sulphur-containing rings. Those mercaptan groups which remain unchanged determine the solubility of the dyes in alkalie. These groups however may be oxidised to disulphide linkages, which render the dyes insoluble in water or alkalie, but may, in turn, be reduced to the mercaptan group with sodium sulphide, in which form the dye dissolves and can then be applied to the fibre. It is then reconverted by oxidation into the original insoluble condition, with the formation of the disulphide linkage:

$$\text{—S—S—} \rightarrow \text{—SH HS—} \rightarrow \text{—S—S—}$$

Since the sulphur dyes cannot be sub-divided according to their chemical constitution, it is convenient to group them in regard to their colour.

The following are the more important sulphur dyes which are met with in commerce:

Yellow, Orange and Brown Sulphur Dyes

Kryogene Yellow G, 2G (C.I. 952). Action of sodium polysulphide on *m*-toluenedithiourea and benzidine

Immedial Yellow GG (C.I. 955). Action of sodium polysulphide on mixture of dehydrothio-*p*-toluidine and benzidine.

Immedial Orange C (C.I. 949). Action of sodium polysulphide on *m*-toluylene-diamine.

Thiophor Bronze 5G (C.I. 946). Action of sodium polysulphide on mixture of *p*-phenylenediamine and *p*-amino-acetanilide.

Kryogene Brown G (C.I. 940). Action of sodium bisulphite and sodium polysulphide on 1.8-dinitro naphthalene.

Immedial Brown B (C.I. 939). Action of sodium polysulphide on 2.4-dinitro-4′-hydroxydiphenylamine.

Eclipse Brown B (C.I. 938). Action of polysulphides on *m*-toluylenediamine and oxalic acid.

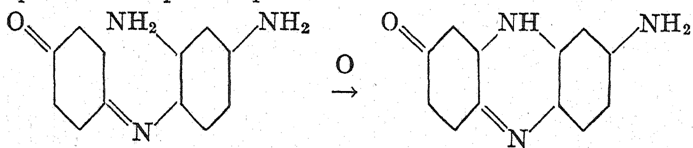
Immedial Yellow Olive 5G. Action of sulphur on a mixture of *p*-phenylene-diamine and *m*-toluylenediamine.

(A.P. 904,809; E.P. 3,279 of 1907; G.P. 196,753.)

Bordeaux and Violet Sulphur Dyes

Bordeaux to violet sulphur dyes are made by the action of sodium polysulphide on amino-oxy-phenazine derivatives, with or without copper salts.

The amino-oxy-phenazines are obtained by the oxidation of the indophenol from *p*-aminophenol and *m*-diamines.



Immedial Bordeaux G (C.I. 1012). By the action of sodium polysulphide on the amino-oxy-phenazine from *p*-aminophenol and *m*-toluylenediamine.

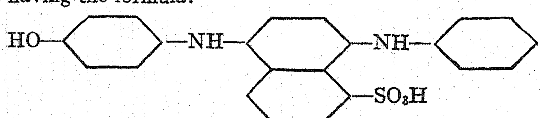
Thiogene Purple O (C.I. 1010). By the action of sodium polysulphide on the amino-oxy-ethylphenazine from *p*-nitrosophenol and mono-ethyl-*m*-toluylene diamine.

(A.P. 818,980; 829,740; E.P. 2,797 of 1906; G.P. 171,177; 181,125).

Green Sulphur Dyes

Pyrogene Dark Green B, 3B (C.I. 1002). Action of sodium polysulphide on *p*-aminophenol in the presence of copper.

Immedial Green GG (C.I. 1006). Action of sodium polysulphide in the presence of copper on 1-arylamino-4-*p*-oxy-phenylaminonaphthalene-sulphonic acids of the type having the formula:



Blue Sulphur Dyes

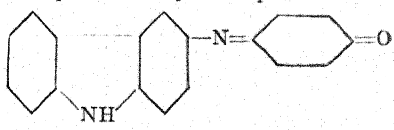
Blue sulphur dyes are produced, in general, by the action of sodium polysulphide on indophenol and diphenylamine derivatives.

Immedial Pure Blue (C.I. 957). Action of sodium polysulphide on 4-dimethylamino-4′-hydroxydiphenylamine (from *p*-amino, dimethylaniline and phenol).

Immedial Indone R (C.I. 959). Action of sodium polysulphide on the indophenol from *o*-toluidine and *p*-aminophenol.

Thiophor Indigo CJ (C.I. 963). Action of sodium polysulphide on the indophenol from *p*-aminodimethylaniline and α-naphthol.

Hydron Blue R (C.I. 969). Carbazol Vat Blue R (TC) Action of sodium polysulphide on the indophenol from *p*-nitrosophenol and carbazol.



Hydron Blue G (C.I. 971). Carbazol Vat Blue G (TC). Action of sodium polysulphide on N-ethylcarbazol indophenol.

Immedial Indogene GCL. Prolonged fusion of the indophenol from dimethylaniline and *p*-aminophenol with a large excess sodium polysulphide.

Immedial Direct Blue B Conc. Action of sodium polysulphide and alcohol under pressure on dinitro-oxydiphenylamine.

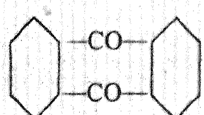
Black Sulphur Dyes

By far the most important of the sulphur blacks are those obtained by the action of sodium polysulphide on 2.4-dinitro phenol, or dinitro chlorbenzene. The process is carried out under different conditions, resulting in the formation of a variety of brands which appear on the market as *Sulphur Black* (TC) (C.I. 978).

Immedial Black FF Ex. (C.I. 988). Action of sodium polysulphide on 2.4-dinitro-4 -hydroxydiphenylamine (from 2.4-dinitrochlorbenzene and *p*-aminophenol).

The Anthraquinone Dyes

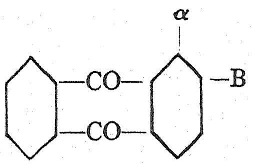
The dyes in this class are derivatives of anthraquinone:



and comprise as a whole colouring matters remarkable for the fastness of their dyeings, and for this reason are widely used.

A great variety of anthraquinone derivatives have been discovered which find use as dyes. The nature and position of substituting

groups in the anthraquinone molecule determine the colour and dyeing properties of its derivatives. With the simple derivatives the influence of a group is always much greater when in the α-position than when in the β-position.



As in other dyes, the influence of the substituents may be arranged in the following order:

—NO_2, —Cl, —Br, —OH, —SH, —NH_2, —NHAlkyl, —NH Aryl.
Least influence **Most influence**

The large number of anthraquinone derivatives which find commercial use may be classified according to their constitution. Of the important classes which may be mentioned are Hydroxy derivatives, Amino- and Arylamino- derivatives, Acylamino-derivatives, Benzanthrones, Dibenzanthrones, Acridones, Thioxanthones, Pyranthrones, Thiazoles and Azines.

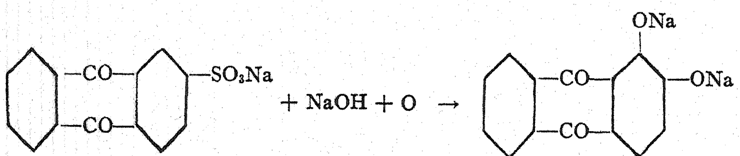
It is thought advisable, however, to subdivide the anthraquinone dyes into three main classes according to their methods of application, and these, in turn, will be subdivided with reference to their chemical constitution.

1. Mordant-dyeing Anthraquinone Derivatives.
2. Anthraquinone Acid Dyes.
3. Anthraquinine Vat Dyes.

1. Mordant-dyeing Anthraquinone Dyes

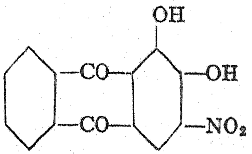
Hydroxy Derivatives

Alizarine (TC) (C.I. 1027). One of oldest and most important dyes. It is made by fusing β-anthraquinone-monosulphonic acid with caustic soda in the presence of an oxidising agent such as sodium chlorate or nitrate.



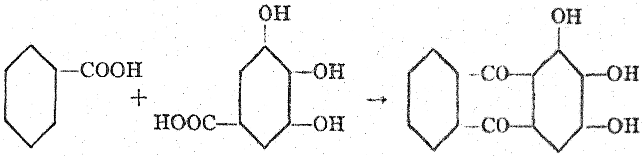
Alizarine (Sodium Salt)

Alizarine Orange (TC) (C.I. 1033). Action of nitric acid on Alizarine, with formation of 3-nitro-1.2-dihydroxyanthraquinone.

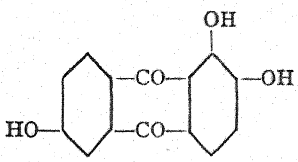


Alizarine Red S (TC) (C.I. 1034). Sulphonation of Alizarine to 1.2-dihydroxy-anthraquinone-3-sulphonic acid.

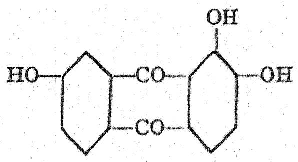
Alizarine Brown (TC) (C.I. 1035). 1.2.3-Trihydroxyanthraquinone, produced by the condensation of gallic acid with benzoic acid.



Alizarine RG (TC) (C.I. 1039). Flavopurpurine. Produced in a similar manner to Alizarine from anthraquinone-2.6.-disulphonic acid. It has the formula:



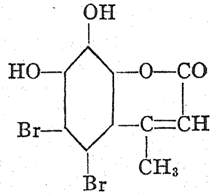
Alizarine Y (TC) (C.I. 1040). Anthrapurpurine. Produced in a similar manner to Alizarine from anthraquinone-2.7-disulphonic acid. It has the formula:



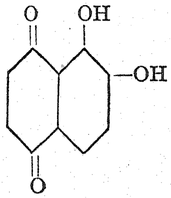
Anthracene Blue WR (TC) (C.I. 1062). Action of fuming sulphuric acid on 1.5-dinitro-anthraquinone and subsequent formation of 1.3.4.5.7.8-hexahydroxy-anthraquinone.

There is a small class of Hydroxy-ketone dyes which are not anthraquinone derivatives, but on account of their similarity to the mordant dyeing Hydroxy-anthraquinone dyes, it is thought advisable to mention them here.

Anthracene Yellow (C.I. 1018). Bromination of dioxy-β-methylcoumarine. which is obtained by the condensation of pyrogallol with aceto-acetic ester. It has the formula:

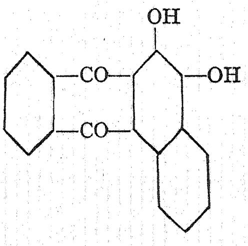


Alizarine Black S (C.I. 1019). The sodium bisulphite compound of 1.2-dihydroxy-α-naphthoquinone (Naphthazarine), this being formed by the action of sulphur and fuming sulphuric acid on crude dinitronaphthalene (1.5- and 1.8-dinitro compounds). Naphthazarine has the following constitution:



Amino-anthraquinone Derivatives

Alizarine Blue X (C.I. 1066). Heating a mixture of glycerin, β-amino-alizarine and β-nitro-alizarine in sulphuric acid solution. It has the formula:

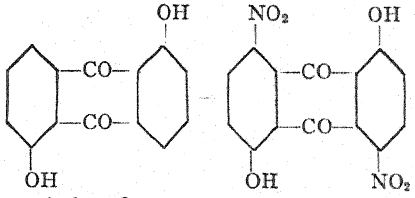


Alizarine Blue S, SW (C.I. 1067). Sodium bisulphite compound of Alizarine Blue X.

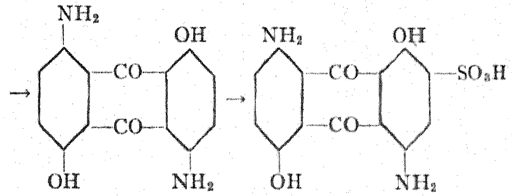
Alizarine Green X, WX (C.I. 1071). Action of sulphuric acid on Alizarine Blue X with formation of a mixture of Tri- and Tetra-oxyanthra-quinone-quinoline, and their sulphonic acids.

2. Anthraquinone Acid Dyes

Acid Alizarine Blue SE (TC) (C.I. 1053). Produced from 1.5-dihydroxyanthraquinone (anthrarufine) by nitration, reduction and sulphonation to the mono-sulphonic acid according to the following reactions:

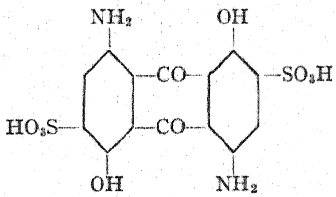


Anthrarufine

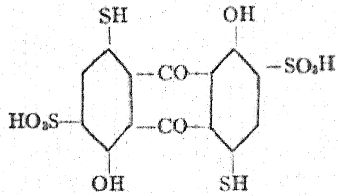


Acid Alizarine Blue SE

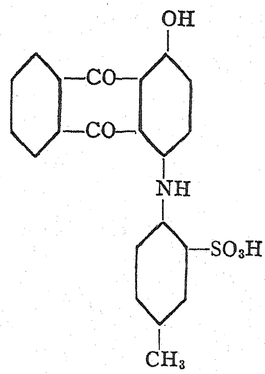
Acid Alizarine Blue B (TC) (C.I. 1054). Prepared by sulphonating anthrarufine to the disulphonic acid, and subsequent nitration and reduction to form a product with the formula:



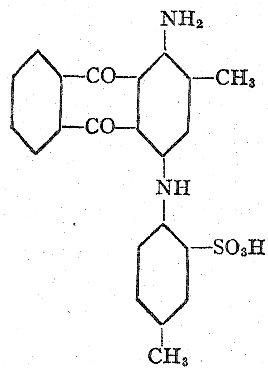
Acid Alizarine Green G (TC) (C.I. 1056). Action of sodium sulphide on dinitro-anthrarufine-disulphonic acid. Its probable formula is:



Alizarine Irisol D (C.I. 1073). Sulphonation of the condensation product obtained from 1.4-dihydroxyanthraquinone (Quinizarine) and *p*-toluidine. It has the formula:

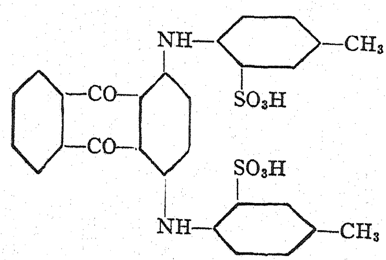


Acid Alizarine Blue R (TC) (C.I. 1076). A derivative of methyl-anthraquinone with the following probable constitution:

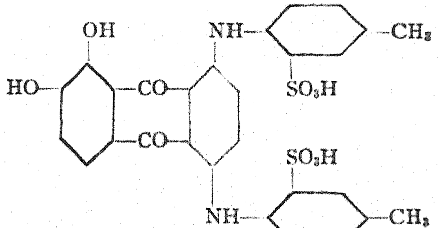


Cyananthrol G (C.I. 1077). A derivative of methyl-anthraquinone of similar constitution to Acid Alizarine Blue R.

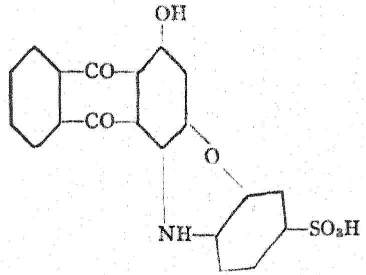
Alizarine Cyanine Green (TC) (C.I. 1078). Sulphonation of the condensation product from Quinizarine and two molecules of *p*-toluidine. It has the following constitution:



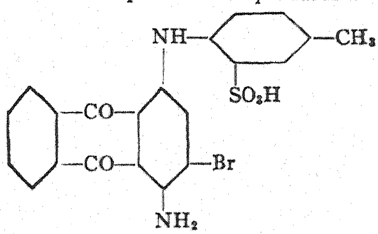
Alizarine Viridine FF (C.I. 1084). Sulphonation of the condensation product from Alizarine Bordeaux (1.2.5.8-Tetrahydroxyanthraquinone) with *p*-toluidine. It has the formula:



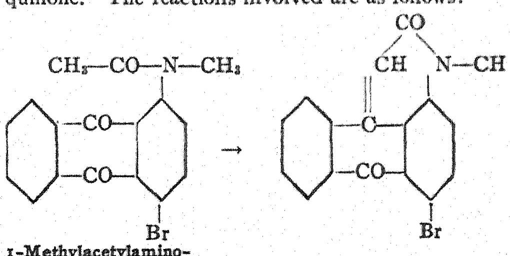
Alizarine Blue Black B (TC) (C.I. 1085). Sulphonation of the condensation product from Purpurine (1.2.4-Trihydroxyanthraquinone) and aniline. Its probable constitution is:



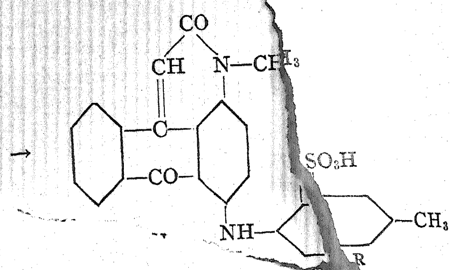
Alizarine Pure Blue B (C.I. 1088). Sulphonation of the condensation product from 2.4-dibrom-1-aminoanthraquinone with *p*-toluidine. It has the formula:



Alizarine Rubinol R (C.I. 1091). Sulphonation of 4-*p*-toluido-1-methylanthrapyridone, which is obtained from 1-methylacetylamino-4-bromanthraquinone. The reactions involved are as follows:



1-Methylacetylamino-4-bromanthraquinone



Alizarine Rubinole

The Vat Dyes

The important colouring matters known as Vat Dyes may be divided chemically into a number of different classes, some of them widely different from each other.

Before 1901 Indigo was the only vat dye known, but since that time many have been discovered, and they have found wide use in the dyeing and printing of textiles because of their excellent fastness properties.

The term "Vat Dye" is used to designate any colouring matter insoluble in water, which can be converted by reduction into a soluble form (leuco compound), in which form it shows affinity for the fibre, and which may be reconverted into the original dye by oxidation.

The fastest vat dyes are Anthraquinone derivatives, but many commercially valuable ones are derivatives of Indigo, Thioindigo and other benzene and naphthalene compounds. A sharp division is not possible, however, as some dyes may be regarded as belonging equally to two classes.

The vat colours of commercial importance may be subdivided into the following groups:

1. Vat Dyes of the Anthraquinone Series.
2. Indigo and Indigoid Vat Dyes.
3. Benzoquinone Vat Dyes.

Vat Dyes of the Anthraquinone Series

The vat-dyeing properties of the anthraquinone colours are due to the presence of two $>CO$ groups which are capable of being changed by reduction into $\rightarrow C{-}OH$ groups, which can form soluble alkali salts. Two $>CO$ groups are not enough to endow an anthraquin-

one derivative with vat-dyeing properties, and other groups which act as chromophores or auxochromes must be present. For example: 1-amino-anthraquinone is a reddish-brown product but has no vat-dyeing properties; however, when it is benzoylated to 1-benzoyl-amino-anthraquinone a vat colour known as Algol Yellow WG. is formed.

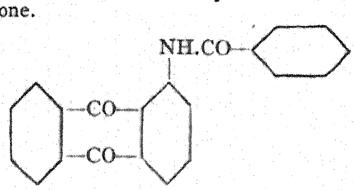
The vat dyes of the anthraquinone series mostly form intensely coloured vats in distinction from the indigo and thioindigo dyes, whose vats are usually yellow to yellow-brown in colour.

In order to facilitate the study of the Anthraquinone Vat Dyes they are classified according to their chemical constitution under the following groups.

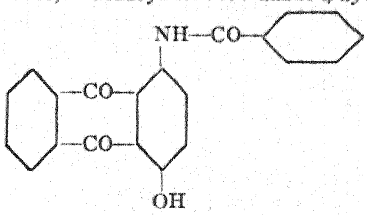
1. Acyl-amino Derivatives
2. Anthraquinone-imide Derivatives
3. Dibenzanthrone Derivatives
4. Pyranthrone Derivatives
5. Azine Derivatives
6. Anthraquinone-acridone Derivatives
7. Flavanthrone
8. Thiazole Derivatives
9. Thioxanthone Derivatives
10. Unknown Constitution.

1. *Acyl-amino Derivatives.*—Anthraquinone derivatives which contain one or more —NH.CO.R groups, wherein "R" designates an aliphatic or aromatic residue.

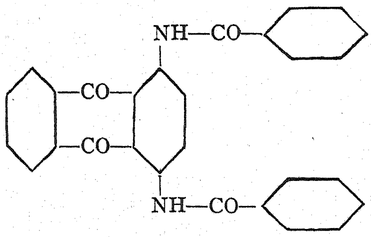
Algol Yellow WG (C.I. 1126). Made by the action of benzoyl chloride on 1-amino-anthraquinone.



Algol Pink R (C.I. 1128). Benzoylation of 1-amino-4-hydroxyanthraquinone

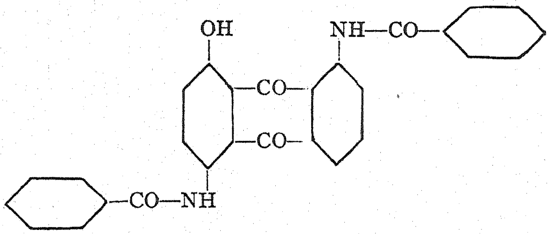


Indanthrene Red 5GK (C.I. 1131). Benzoylation of 1.4-diaminoanthraquinone.

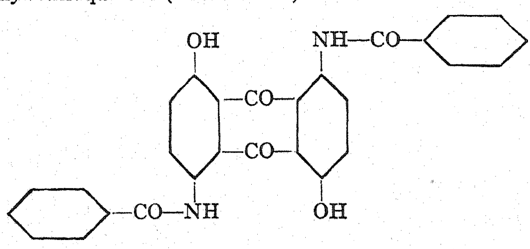


Indanthrene Yellow GK (C.I. 1132). Benzoylation of 1.5-diaminoanthraquinone.

Algol Red FF (C.I. 1133). Benzoylation of 1.5-diamino-8-hydroxyanthraquinone

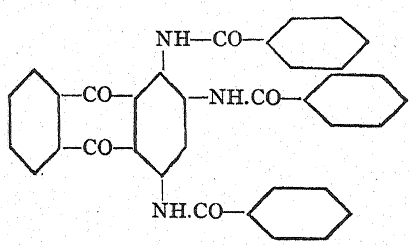


Indanthrene Brilliant Violet BBK (C.I. 1134). Benzoylation of 1.5-diamino-4.8-dihydroxyanthraquinone (Anthrarufine).

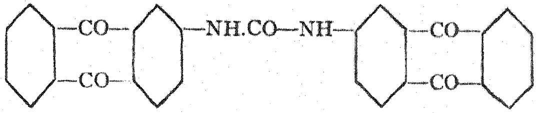


Indanthrene Brilliant Violet RK (C.I. 1135). Action of anisoyl chloride on anthrarufine.

Indanthrene Orange RRK (C.I. 1136). Benzoylation of 1.2.4-triaminoanthraquinone.

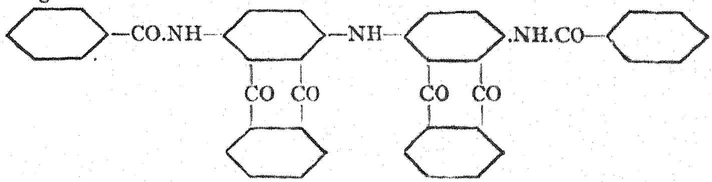


Helindone Yellow 3GN (C.I. 1138) is a urea derivative formed from 2-anthraquinonylurea chloride and 2-amino-anthraquinone.



More complex acyl-amino derivatives whose constitutions are not definitely known are:

Indanthrene Olive R (C.I. 1150). Condensation of 1-benzoylamino-4-chloranthraquinone with 1-benzoylamino-4-amino-anthraquinone to form product having the formula:

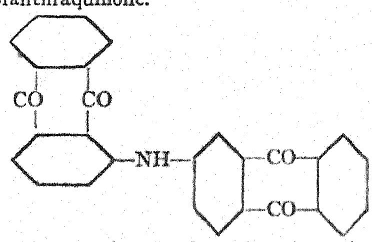


The product is then treated with chlorsulphonic acid at a low temperature to form the dye.

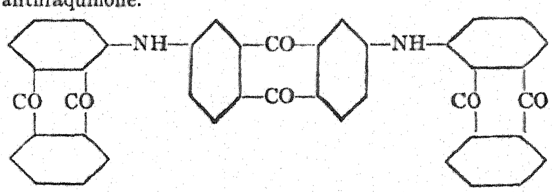
Indanthrene Brown R (C.I. 1151). Prepared in a similar manner to the above Olive R from the condensation product from 1-benzoylamino-5-chloranthraquinone with 1-benoylamino-4-aminoanthraquinone.

2. *Anthraquinone-imide Derivatives.*—These products are characterised by the imide group (—NH—) uniting two or more anthraquinone molecules.

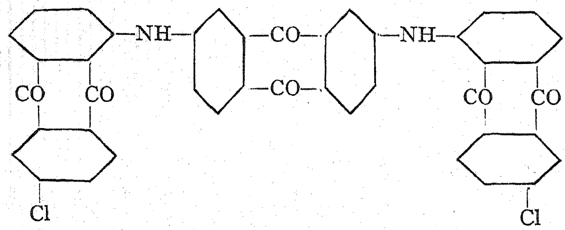
Indanthrene Orange 6RTK (C.I. 1137). Condensation of 1-aminoanthraquinone with 2-chloranthraquinone.



Indanthrene Red R (C.I. 1142). Condensation of 1-aminoanthraquinone with 2.7-dichloranthraquinone.

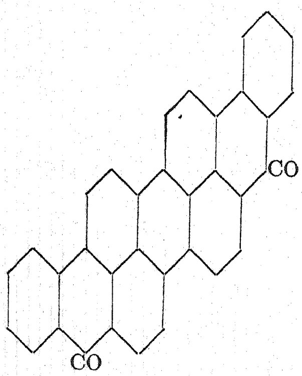


Anthra Bordeaux R (C.I. 1143). Condensation of 2 molecules of 1-amino-6-chloranthraquinone with 2.7-dichloranthraquinone.

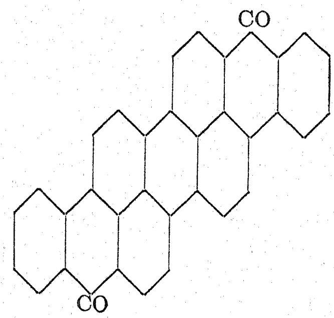


Indanthrene Grey GK (C.I. 1145). Nitration of the condensation product from 1.5-diaminoanthraquinone and two molecules of 1-chloranthraquinone.

3. *Dibenzanthrone Derivatives.*—The dyes in this group are characterised by the condensed anthraquinone complexes known as Dibenzanthrone and Isodibenzanthrone.

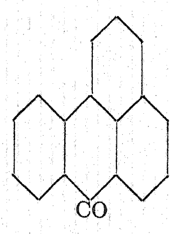


Dibenzanthrone (Violanthrone)



Isodibenzanthrone (Isoviolanthrone)

Dibenzanthrone is formed by fusing benzanthrone, which has the formula:



with caustic potash, while Iso-dibenzanthrone is formed from β-chlorbenzanthrone in a similar manner.

Anthraquinone Vat Dark Blue BO (TC) (C.I. 1099). This is dibenzanthrone and has the above formula.

Caledone Jade Green (C.I. 1101). Dibenzanthrone is oxidised to a dihydroxy-derivative, which is then methylated with dimethylsulphate, forming a dimethoxy-dibenzanthrone.

(A.P. 1,531,261; 1,531,262; E.P. 181,304 of 1920.)

Anthraquinone Vat Green B (TC) (C.I. 1102).

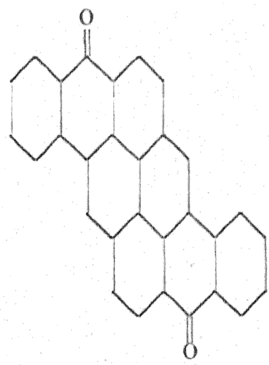
Anthraquinone Vat Black B (TC) (C.I. 1102). Dibenzanthrone is nitrated. This product dyes cotton *green*, which, when after-treated with chlorine, turns *black*.

Indanthrene Violet R (C.I. 1103) is Iso-dibenzanthrone, made by the alkali fusion of β-chlorbenzanthrone.

Anthraquinone Vat Violet RR (TC) (C.I. 1104). Chlorination of isodibenzanthrone to its dichlor-derivative.

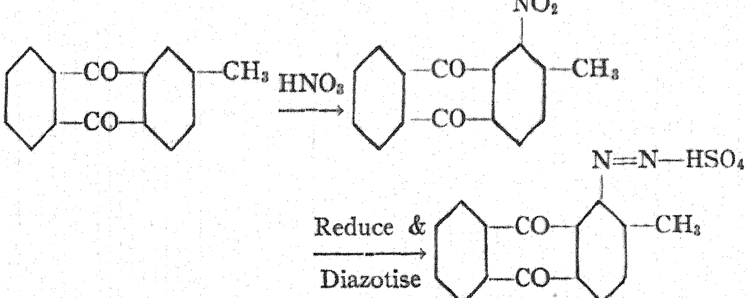
Anthraquinone Vat Violet B (TC) (C.I. 1105). Bromination of isodibenzanthrone to its dibrom-derivative.

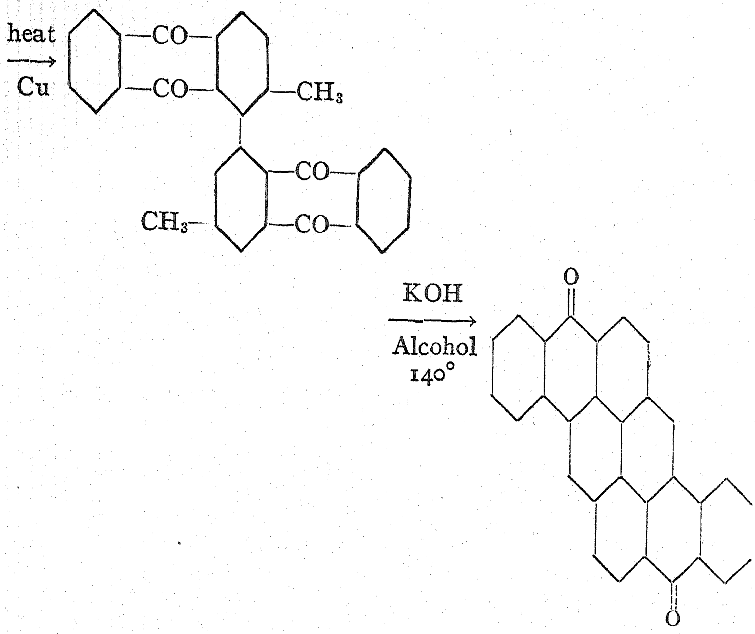
4. *Pyranthrone Derivatives.*—The dyes of this group are characterised by the molecular complex known as Pyranthrone. It has the following constitution:



Pyranthrone

The starting point for this product is 2-methyl-anthraquinone, which may be converted into Pyranthrone by the following series of reactions:





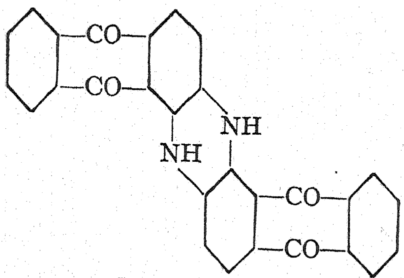
Pyranthrone

Anthraquinone Vat Golden Orange G (TC) (C.I. 1096) is Pyranthrone.

Anthraquinone Vat Golden Orange R (TC) (C.I. 1097). Chlorination of Pyranthrone to its di- or tri chlor-derivative.

Indanthrene Scarlet G (C.I. 1098). Bromination of Pyranthrone to its dibrom-derivative.

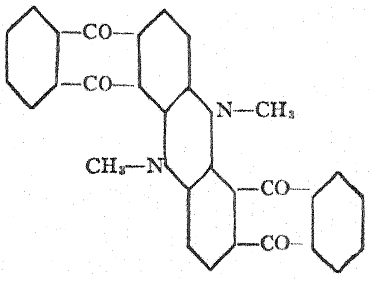
5. *Azine Derivatives.*—The dyes of this group are characterised by the anthraquinone-azine complex of the following constitution:



Indanthrene

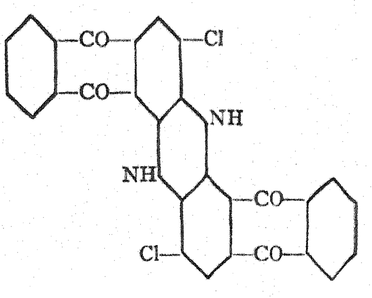
Indanthrene Blue R (C.I. 1106). Fusion of 2-amino-anthraquinone with caustic potash in the presence of an oxidising agent.

Indanthrene Blue RK (C.I. 1108). Heating 2-brom-1-methylaminoanthraquinone with sodium acetate and copper chloride. It has the formula:



Anthraquinone Vat Blue 3G (TC) (C.I. 1109). Indanthrene sulphonic acid is heated with sulphuric acid and boric acid, producing most probably an oxy-indanthrene.

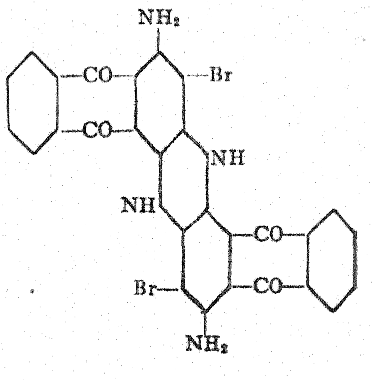
Anthraquinone Vat Blue GCD (TC) (C.I. 1113). Chlorination of Indanthrene Blue R to its dichlor-derivative. It has the formula:



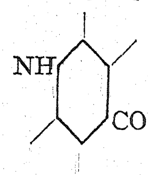
Anthraquinone Vat Blue BCS (TC) (C.I. 1114). Chlorination of Indanthrene Blue R to its trichlor-derivative.

Anthraquinone Vat Blue GC (TC) (C.I. 1115). Bromination of Indanthrene Blue R to its dibrom-derivative.

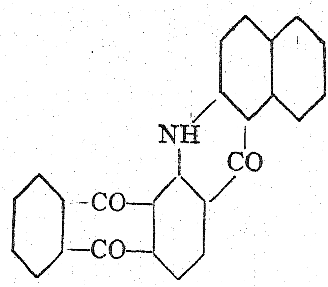
Indanthrene Green BB (C.I. 1116). Condensation of 2.3-dibrom-1.4-diamino-anthraquinone with itself by heating with sodium acetate and copper. It has the formula:



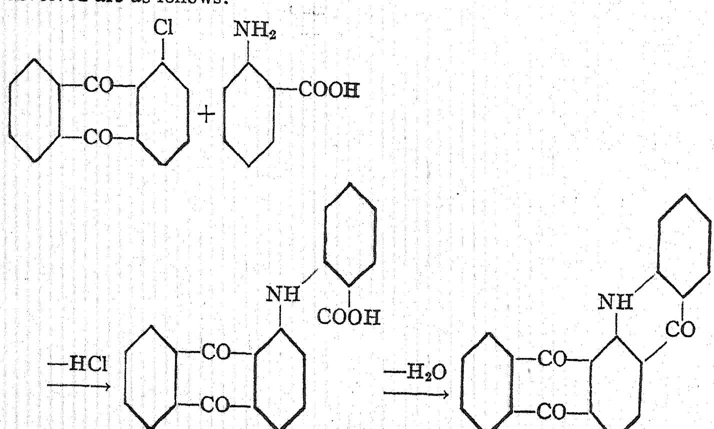
6. *Anthraquinone-acridone Derivatives.*—The dyes in this group are characterised by the acridone grouping,

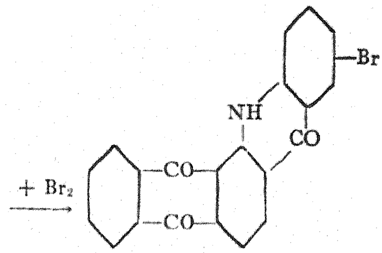


One or more acridone groups may be present in the molecule uniting an anthraquinone residue with another or with a benzene or naphthalene nucleus. Those derivatives in which the imide (—NH—) group is united with the anthraquinone nucleus at the alpha or (1) position are tinctorially the most valuable. Such a derivative is represented by the formula for Indanthrene Red BN, which is as follows:

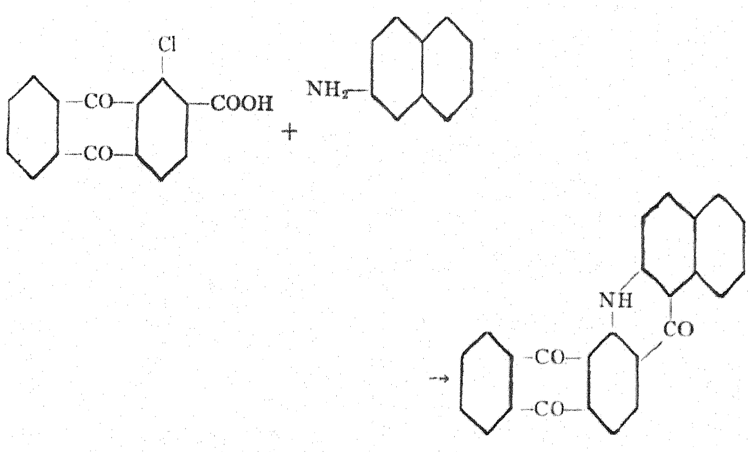


Indanthrene Red Violet RRK (C.I. 1161). Bromination of the acridone formed by condensation of 1-chlor-anthraquinone with anthranilic acid. The reactions involved are as follows:

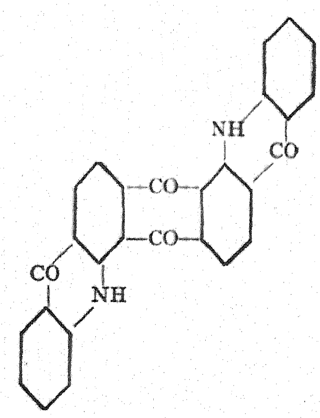




Anthraquinone Vat Red BN (TC) (C.I. 1162). Condensation of 1-chloranthraquinone-2-carboxylic acid with 2-naphthylamine

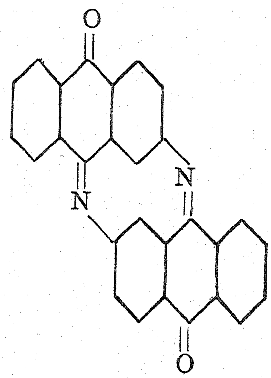


Indanthrene Violet BN Ex. (C.I. 1163). Condensation of 1.5-dichloranthraquinone with anthranilic acid. It has the following constitution:

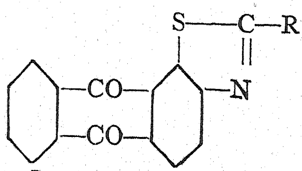


Indanthrene Pink B Ex. 1-Phenylamino-2-methyl-anthraquinone is chlorinated in an inert solvent to form a chlor-anthraquinone acridone. (A.P. 1,133,081; G.P. 272,296; 275,671; 283,724.)

7. *Flavanthrone.*—The only important dyes of this group are Indanthrene Yellow G and R, which are formed by the action of antimony pentachloride on 2-aminoanthraquinone. The main product formed by this condensation is known as Flavanthrone and is given the following constitutional formula:

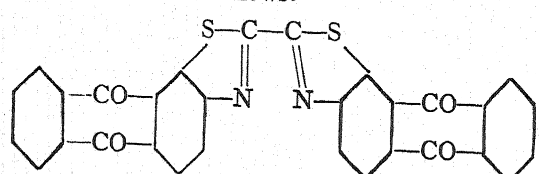


8. *Thiazole Derivatives.*—The dyes of this group are anthraquinone derivatives which are characterised by one or more thiazole groups, the sulphur of the thiazole group being in the alpha or (1) position in the anthraquinone nucleus:



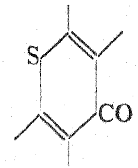
R = Aryl group or residue

Anthraflavone GC is a representative of this class produced from 1-chlor-2-acetaminoanthraquinone by the action of sulphur. Its probable constitution is as follows:



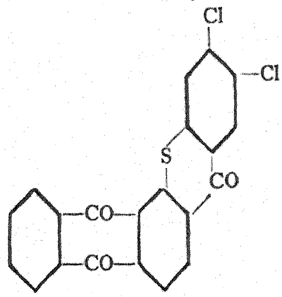
(A.P. 1,126,475; E.P. 21,027 of 1913 G.P. 280,982.)

9. *Thioxanthone Derivatives.*—The dyes of this group are characterised by the Thioxanthone Grouping:



united to an anthraquinone nucleus in such a manner that the —S— is connected at the alpha or (1) position of the anthraquinone residue.

Indanthrene Golden Orange GN (C.I. 1164). Condensation of 3.4-dichlorthiophenol with 1-chloranthraquinone-2-carboxylic acid. It has the formula:



Indanthrene Yellow GN Ex. (C.I. 1165) is prepared in a similar manner from 2.5-dichlorthiophenol and 1-chloranthraquinone-2-carboxylic acid.

10. *Anthraquinone Vat Dyes of Unknown Constitution.*

Anthraquinone Vat Brown B (TC) (C.I. 1120). Action of copper powder on sulphuric acid solution of 2-aminoanthraquinone.

Indanthrene Olive G (C.I. 1167). Action of sulphur in the presence of metallic oxides on anthracene.

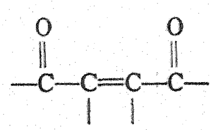
Cibanone Orange R (C.I. 1169). Action of sulphur on 2-methylanthraquinone or its chlor-derivatives.

Cibanone Yellow R (C.I. 1170). Action of sulphur on 3-chlor-2-methylanthraquinone or its chlor-derivatives.

Cibanone Black B (C.I. 1172), *Cibanone Blue 3G* (C.I. 1173) and *Cibanone Green B* (C.I. 1174) are all produced by the action of sulphur on 2-methylbenzanthrone at various temperatures.

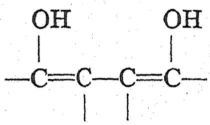
Indigo and Indigoid Vat Dyes

The dyes of this group are characterised by the presence of the chromophoric group:



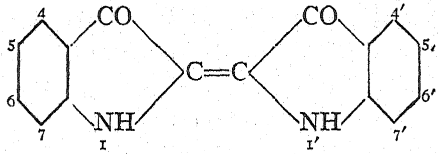
one carbon atom on each side of the double bond must be united with an aromatic ring system, and the other one with an atom or a group.

This chromophoric group is capable of reduction, with formation of the following group:

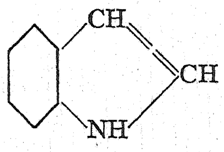


which forms soluble alkali salts, thus rendering the dye soluble.

The chromophoric group may be united with many different ring systems, so that a great variety of products is formed. The simplest member of this class is the important vat dye, Indigo. It is given the following constitutional formula:

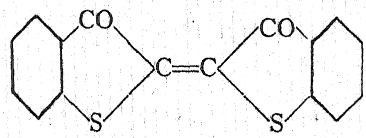


The positions of substituting groups in the Indigo molecule are indicated by the numbers in the above manner. Since Indigo may be regarded as a derivative of Indol:

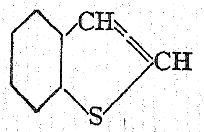


it may be termed 2.2′-bis-indol-indigo.

If the —NH— group is replaced with —S— we have Thioindigo Red, or more accurately, 2.2′-bis-thionaphtheneindigo:



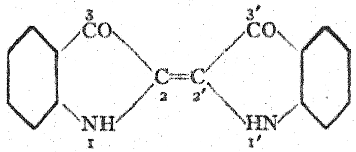
since it may be considered as a derivative of Thionaphthene:



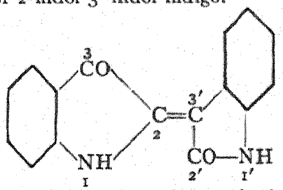
Indigo and Thioindigo have symmetrical configurations, and many derivatives are known which contain substituting groups at the same relative positions in each benzene ring. It is possible, however, to make asymmetrical products, that is, an Indol derivative may be combined with a Thionaphthene derivative, or either may be combined with an entirely different ring system, as acenaphthene, naphthalene or anthracene.

The commercially valuable Indigoid Dyes may be classified according to the following scheme:

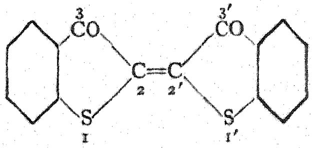
1. Indigo Group or 2.2′-bis-indol-indigo.



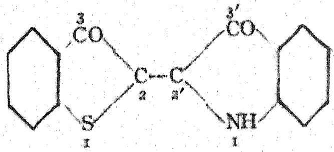
2. Indirubine Group or 2-indol-3′-indol-indigo.



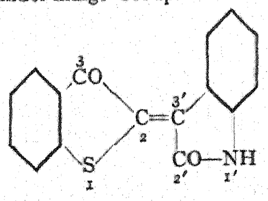
3. Thioindigo Group or 2.2′ -bis-thionaphthene-indigo.



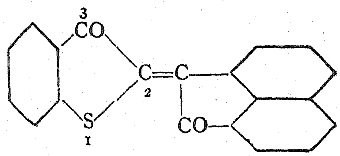
4. 2-Thionaphthene-2′-indol-indigo Group.



5. 2-Thionaphthene-3′-indol-indigo Group.



6. 2-Thionaphthene-acenaphthene-indigo Group.

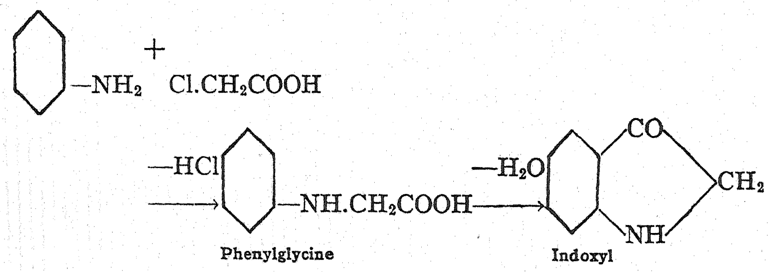


7. Indigoid Dyes with Various Groups.

General Methods of Preparation

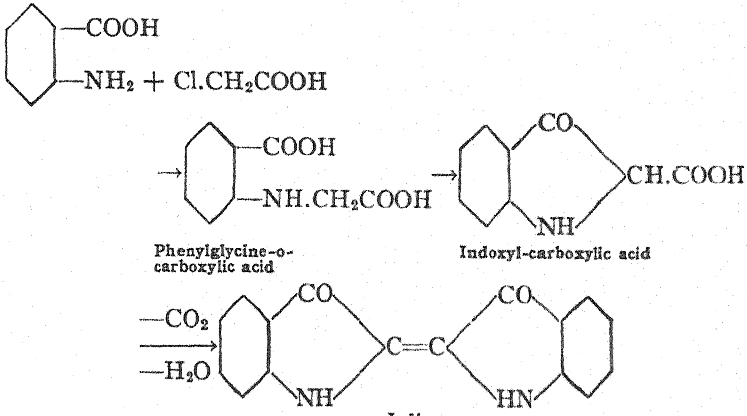
1. Indigo Group: The well known vat dye Indigo is the most important example of this group. It has been prepared synthetically by a great variety of processes; however, it will be sufficient for our purpose to outline one or two of the most important methods used commercially.

K. Herrmann's Synthesis.—Aniline is condensed with chloracetic acid, and the phenylglycine so formed is fused with potash, thus forming Indoxyl which is converted into Indigo by blowing air through the melt. The reactions involved are as follows:



Commercially, this process is modified by the use of sodamide for the fusion, in place of potash.

Synthesis from Anthranilic Acid.—Anthranilic acid is condensed with chloracetic acid to form phenyl-glycine-o-carboxylic acid. This is converted into Indoxyl-carboxylic acid by fusion with caustic alkali, and Indigo formed by oxidation with air.

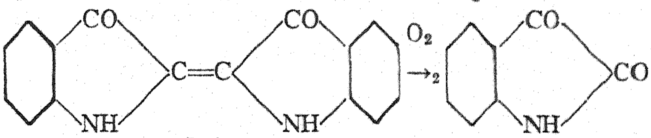


Phenylglycine-o-carboxylic acid

Indoxyl-carboxylic acid

Indigo

Other important dyes of the Indigo group are mostly halogen derivatives. Valuable intermediate products used in the preparation of the asymmetrical Indigoid dyes may be obtained by the oxidation of Indigo or its halogen derivatives with nitric acid. Such products are Isatin, and mono- or di-halogen Isatins.

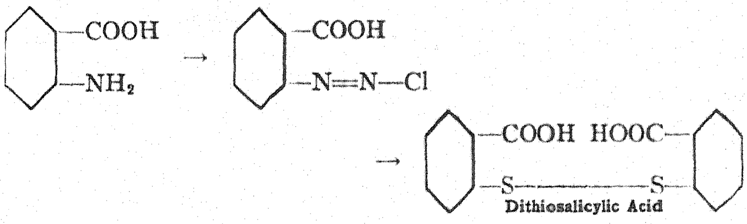


Indigo

Isatin

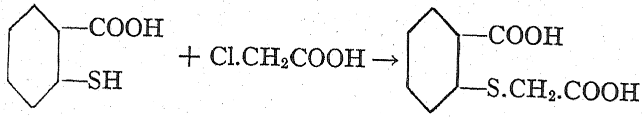
The Thioindigo Group.—The Thioindigo dyes may be prepared in a somewhat similar manner to the methods employed for Indigo.

1. *From o-Amino-carboxylic Acids.*—Anthranilic acid is diazotised, and converted into dithiosalicylic acid by the action of sodium disulphide:

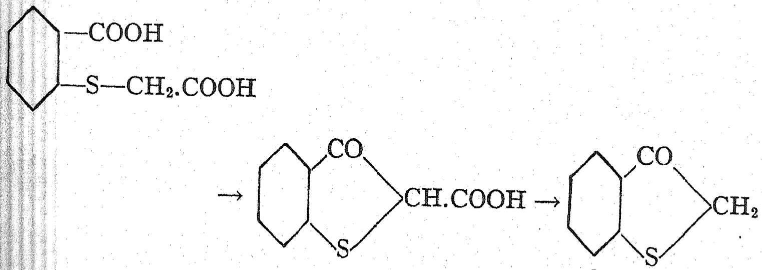


Dithiosalicylic Acid

The dithiosalicylic acid is then reduced to thiosalicylic acid which is condensed with chloracetic acid to form phenylthioglycollic-*o*-carboxylic acid.

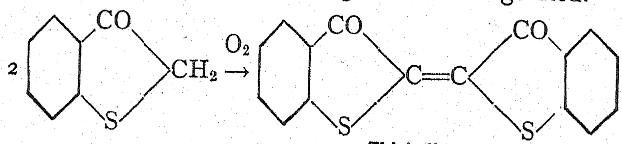


On fusion with alkalies the phenylthioglycollic-*o*-carboxylic acid is converted into 3-oxythionaphthene-2-carboxylic acid, and 3-oxythionaphthene is formed by the elimination of CO_2.



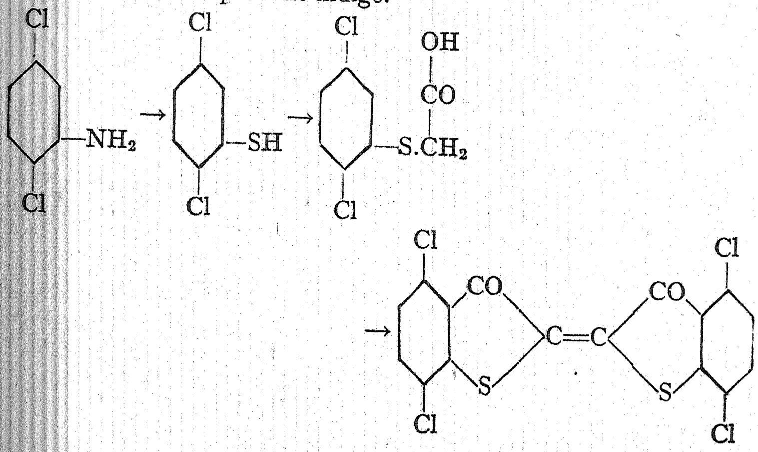
3-Oxythionaphthene

Oxidation of 3-oxythionaphthene gives Thioindigo Red.



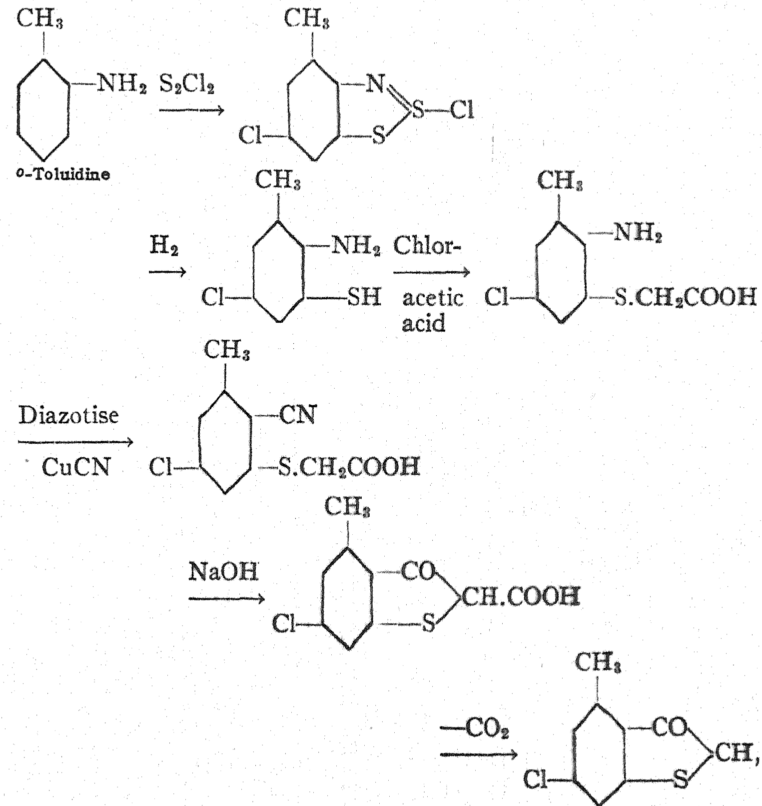
Thioindigo Red

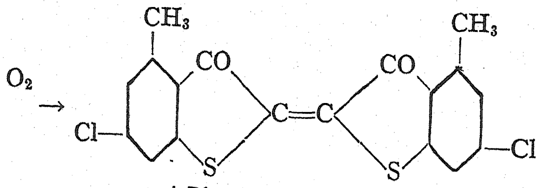
2. *From Substituted Amines.*—Substituted amines are converted into their corresponding thioglycollic acids by the method outlined above, and then converted directly to the colouring matter by condensation at a low temperature with chlorsulphonic acid. In this manner 2.5-dichloraniline may be converted into 4.4′.7.7′-tetrachlor-2.2′-bisthionaphthene-indigo.



3. *The Herz Synthesis.*—A very interesting synthesis has been devised by R. Herz for the preparation of Thioindigo vat dyes from amines. (A.P. 1,243,170; 1,243,171; E.P. 17,417 of 1914; G.P. 360,690; 367,344; 367,346; 364,822; 367,493, 374,503.)

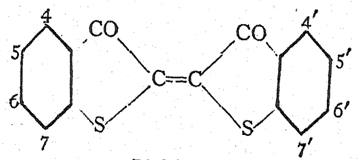
Briefly, the synthesis consists in converting the reaction product obtained by the action of sulphur chloride on amines into *o*-amino-thiophenol derivatives, with which is condensed chloracetic acid to form substituted *o*-amino-phenyl-thio-glycollic acids. The amino group is replaced by the nitrile group by means of the Sandmeyer reaction. The nitrile, so formed, is heated with alkali, and the resulting product converted into a 3-oxythionaphthene derivative by the action of dilute acids. On oxidation of this product the dye is obtained. The reactions involved probably take the following course, starting with *o*-toluidine:



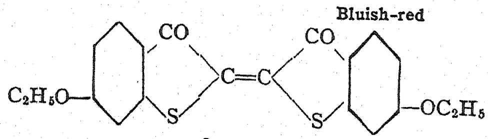


4.4′-Dimethyl-6.6′-dichlor-2.2′-bis-thionaphthene-indigo
(Hydron Pink FF)

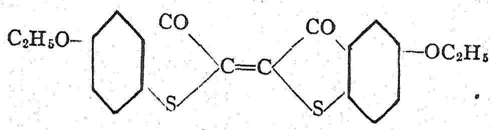
The shade of thioindigo derivatives is greatly affected by the position of substituting groups in the benzene nucleus. The shade is also influenced by the nature of the group. In general, groups in the para-position to the —CO— group, that is in position (6), tend to alter the shade towards yellow, whilst groups para to the sulphur, that is in position (5), alter the shade towards blue. The effect of groups in positions (4) and (7) are less marked, but have a similar effect as in (5). The following examples will illustrate this:



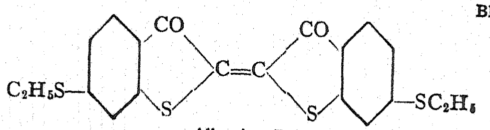
Bluish-red



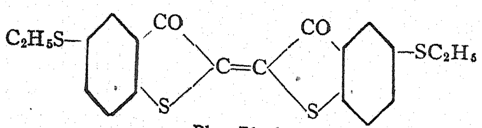
Orange-Red



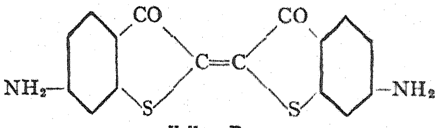
Blue-Violet



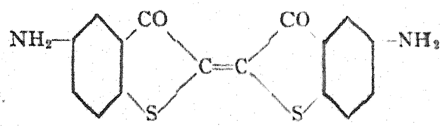
Alizarine-Red



Blue-Black



Yellow-Brown



Green-Black

The most important vat dyes of the Indigo and Thioindigo Series are the following, grouped according to their chemical constitution:

1. Indigo Group or 2.2′-bis-indol-indigo.

Indigo (TC) (C.I. 1177). Its method of preparation has already been mentioned. It is the most important dye of this class.

Indigo Vat I (TC) (1178). This is the readily soluble form of Indigo made by reducing Indigo to its leuco compound in alkaline solution.

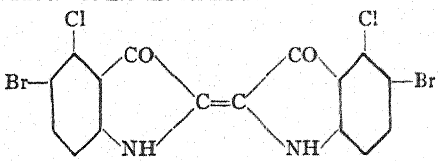
Indigo Extract (TC) (C.I. 1180). Sulphonation of Indigo to its 5.5′-disulphonic acid.

Bromindigo RB (TC) (C.I. 1183). Bromination of Indigo to its 5.5′-dibrom-derivative, mixed with some 5.5′-7-tri- and 5.5′.7.7′-tetrabrom-products.

Bromindigo Blue 2B (TC) (C.I. 1184). Bromination of Indigo to form completely the 5.5′.7.7′-tetrabrom-derivative.

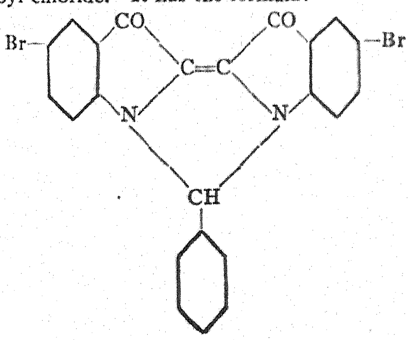
Durindone Blue 6B (C.I. 1186). Bromination of Indigo to its 4.5.7.4′.5′.7′-hexabrom-derivative.

Brilliant Indigo 4G (C.I. 1189). Bromination of 4.4′-dichlorindigo to its 5.5′-dibrom-derivative. It has the formula:

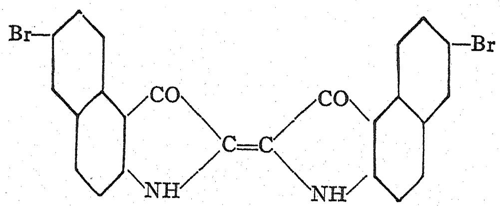


Brilliant Indigo B (C.I. 1190). Chlorination of Indigo to its 5.7.5′.7′-tetrachlor-derivative.

Ciba Yellow G (C.I. 1196). Bromination of the condensation product of Indigo with Benzoyl chloride. It has the formula:

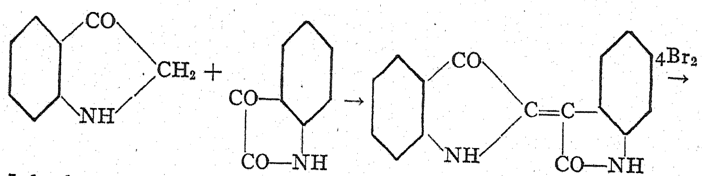


Ciba Green G (C.I. 1198). Bromination of 2.2′-bis-naphthindol-indigo to the dibrom-derivative. It has the formula:

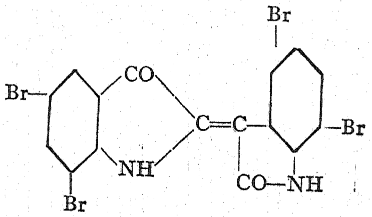


2. Indirubine Group or 2-indol-3′-indol-indigo.

Ciba Heliotrope B (C.I. 1205). Bromination of the condensation product from Isatin with Indoxyl. The reactions are as follows:



Indoxyl **Isatin** **Indirubine**



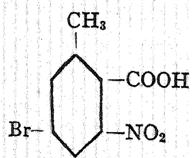
Ciba Heliotrope B

3. Thioindigo Group or 2.2′-bis-thionaphtene-indigo.

Thioindigo Red B (C.I. 1207), may be prepared from anthranilic acid by the methods already outlined under the general methods for the preparation of Thioindigo vat dyes.

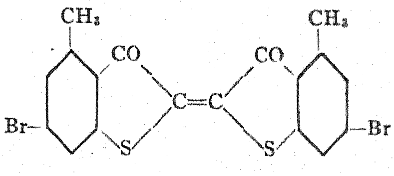
Ciba Bordeaux B (C.I. 1208). Bromination of Thioindigo Red B to its 5.5′-dibrom-derivative.

Helindone Pink BN (C.I. 1211). 4.6-Brom-nitro-*o*-toluylic acid,



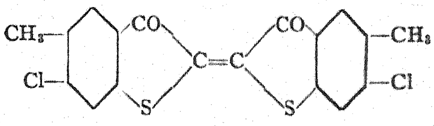
, is reduced to the amino compound and then converted

into the dye by general method No. 1. Its constitutional formula is:



4.4′-dimethyl-6.6′-dibrom-2.2′-bis-thionaphthene-indigo.

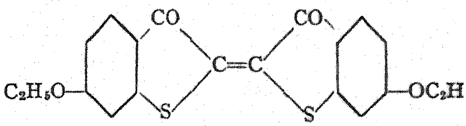
Indanthrene Red Violet RH (C.I. 1212). *o*-Chlor-*p*-toluidine is converted into a thioindigo dye by general method No. 2. Its formula is:



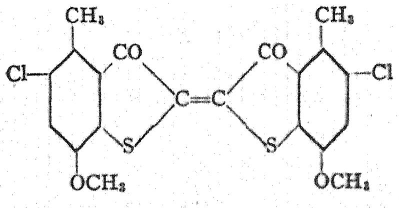
Hydron Pink FF. This is prepared from *o*-toluidine by the Herz synthesis, which has already been outlined.

Helindone Orange D (C.I. 1215). *m*-Aminophenylthio-glycollic acid is converted into 6.6′-diamino thioindigo and this on bromination to the di-brom-derivative gives Helindone Orange D.

Helindone Orange R (C.I. 1217). *p*-Phenetidine is converted by the Herz Synthesis into 6.6′-diethoxy-2.2′-bis-thionaphthene-indigo. It has the formula:

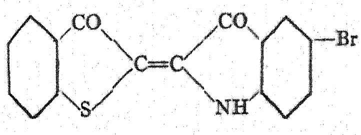


Helindone Violet B (C.I. 1219). 3-Amino-6-chlor-4-cresol methyl ether is converted by General Method No. 2 into Helindone Violet, which is 4.4′-dimethyl-5.5′-dichlor-7.7′-dimethoxy-thioindigo:



4. 2. Thionaphthene-2′-indol-indigo Group.

Ciba Grey G (C.I. 1220). Condensation of 3-oxythionaphthene with 5-brom-isatin-chloride.



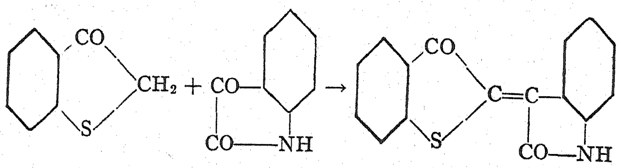
Ciba Violet 3B (C.I. 1221). Bromination of 2-thionaphthene-2′-indol-indigo to the 5.5′-dibrom-derivative.

Ciba Violet B (C.I. 1222). Bromination of 2-thionaphthene-2′-indol-indigo to the 5.5′-7-tri-brom-derivative.

Helindone Brown R (C.I. 1223). Bromination of 2-(amino) thionaphthene-2′-indolindigo.

5. 2-Thionaphthene-3′-indol-indigo Group.

Thioindigo Scarlet (C.I. 1225). Condensation of Isatin with 3-oxythionaphthene.

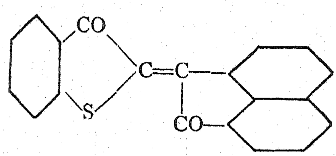


Ciba Red G (C.I. 1226). Condensation of 5.7-dibromisatin with 3-oxy-thionaphthene.

Helindone Brown G (C.I. 1227). Bromination of the condensation product from 6-amino-3-oxythionaphthene with isatin to the tri-brom-derivative.

6. 2-Thionaphthene-acenaphthene-indigo Group.

Ciba Scarlet G (C.I. 1228). Condensation of 3-oxythionaphthene with ace-naphthenone. It has the formula:

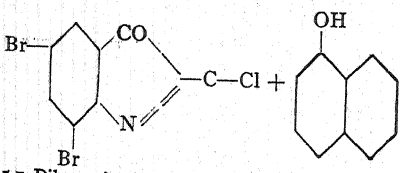


Ciba Red R (C.I. 1229). Bromination of Ciba Scarlet G to its mono-brom-derivative.

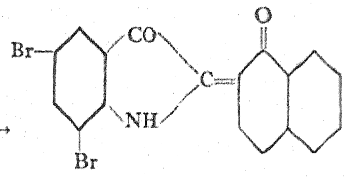
7. Indigoid Dyes with Various Groups.

Compounds containing reactive carbonyl (—CO—) or methylene (—CH_2—) groups such as the aldehydes, ketones, naphthols and anthrols can be made to condense with Isatin, Indoxyl, 3-oxythionaphthene or Thioindoxyl and their derivatives to form a variety of Indigoid colouring matters, some of which have found commercial use.

Alizarine Indigo 3R (C.I. 1200). 5.7-Dibromisatin-chloride is condensed with 1-naphthol to form 5.7-dibrom-2-indol-2′-naphthalene-indigo.

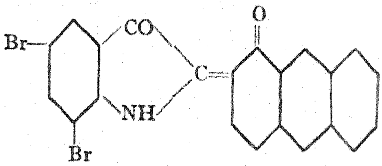


5.7-Dibrom-isatin chloride **1-Naphthol**

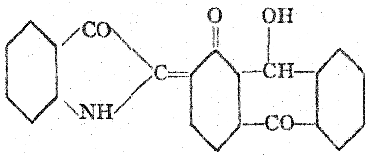


Alizarine Indigo 3R

Alizarine Indigo G (C.I. 1202). 5.7-Dibrom-isatin chloride is condensed with 1-oxyanthracene or 1-anthrol.

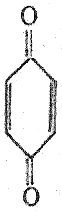


Helindone Blue 3GN (C.I. 1203). Condensation of alpha-isatin anilide with oxyanthranol.



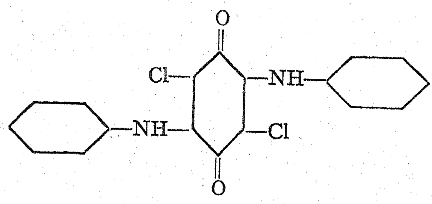
The Benzoquinone Vat Dyes

Vat dyes have been prepared which are derivatives of the simplest aromatic quinone, namely, *p*-benzoquinone



In general, they are prepared by condensing chloranil (tetra-chlorquinone) with amino-compounds, and then subjecting the condensation product to the action of condensing agents, sulphur or sulphur compounds.

Helindone Brown CM, CR, *Helindone Yellow*, CG, (C.I. (1176). Action of sodium polysulphide on diarylido-dichlorbenzoquinones, of the type of dianilido-dichlorbenzoquinone having the following constitution:



(A.P. 1,128,368; E.P. 19,599 of 1912; G.P. 263,382; 265,195; 295,196.)

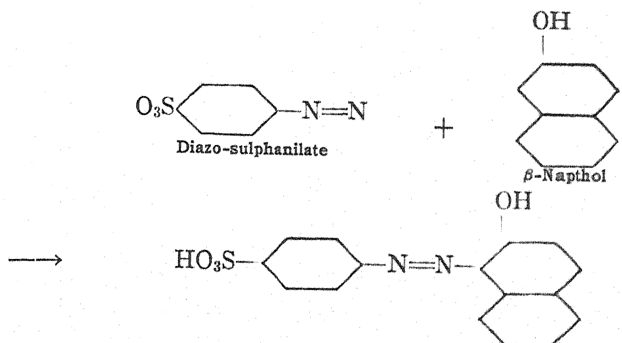
THE IDENTIFICATION OF AZO DYES

The Azo Colouring Matters comprise the largest group of synthetic dyes. Many of them are so close in chemical constitution that identification cannot be effected by the simple methods of colour reactions with various reagents or by means of physical constants.

The spectroscopic examination of the azo dyes is less effective for their identification than is the case with other dyes, as the absorption bands of the individual dyes are often poorly defined, and since there are many azo dyes whose constitutions are very close, identification by this method is practically impossible.

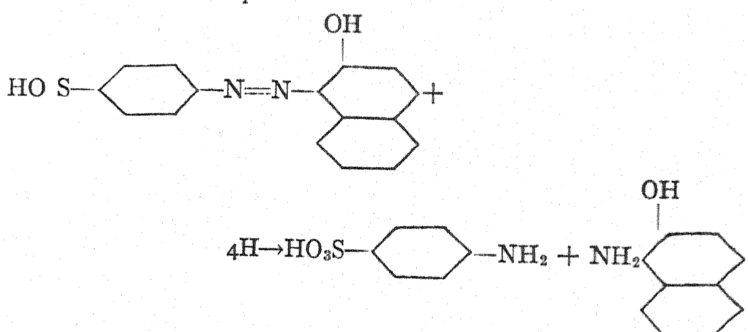
Examination of the oxidation products of the azo dyes, which is effected by means of fuming nitric acid, has been used for their identification, but this method is not very practicable. At best, it may be used to supplement other methods of analysis, such as the reduction method for identifying azo dyes.

The most practicable and advantageous method for the identification of the azo colouring matters is unquestionably by means of complete reduction. The azo dyes contain one or more azo groupings, and complete reduction causes splitting of the molecule at the azo linkage, with formation, in the case of a monazo colour, of two amino derivatives. If the amino compound used for the preparation of the monazo dye does not carry groups which are susceptible to reduction, it will be regenerated in the process of reduction, for example: Orange II is made by coupling diazotised sulphanilic acid with β-Naphthol:



Orange II

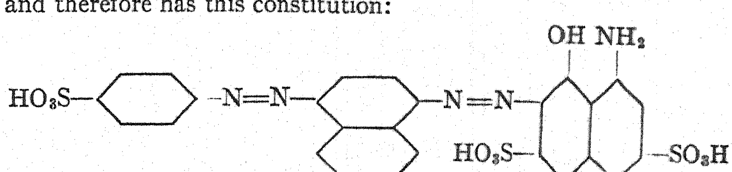
On complete reduction the Orange II is split into sulphanilic acid and 1.2-aminonaphthol:



In the case of disazo colours from diamino bases, such as benzidine, dianisidine, etc., the diamino base will be regenerated, but where disazo, trisazo and tetrakisazo dyes are not prepared from bases of the above character the middle components of the dye molecule will yield derivatives of the original intermediate used in the preparation of the dye, and which will contain an amino group at every position where there is an azo linkage. For example, Acid Black 10B is made with the following intermediates:

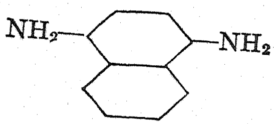
Sulphanilic Acid α-naphthylamine H-Acid

and therefore has this constitution:

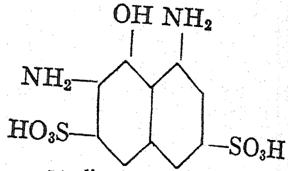


On reduction the following products are formed:

Sulphanilic Acid



1.4-diamino-naphthalene



1.7-diamino-8-naphthol-3.6-disulphonic acid

Colouring matters which are made from nitro-derivatives, such as the nitranilines, nitro-toluidines, nitro-amino-phenols, etc. will yield by the reduction process diamino-derivatives, except in the case where a nitro group is in the ortho position to the azo linkage. In such instances a triazole derivative will usually be formed.

The identification of the reduction products serves to determine the intermediates from which the dye is made; the number of reduction products which must be identified comprises only a small proportion of the number of dyes from which they are obtained.

The physical constants and chemical reactions may be utilised for identifying these products. Such data are not to be found for a great many of the reduction products, but all the information which could be found in the chemical literature has been brought together and will be found collected under the heading "Physical and Chemical Properties of the Reduction Products from Azo Dyes."

The analysis of azo dyes by the reduction method was first applied by O. N. Witt, (*Ber.* 1888, **21**, 3468) who used as the reducing agent stannous chloride dissolved in hydrochloric acid. More recently the use of sodium hydrosulphite has been recommended by Grandmougin, (*Ber.* 1906, **39**, 2484; 3561; 3929). Other reducing agents may also be used, such as zinc dust and ammonia, glucose and caustic soda, etc., which are useful in special cases.

By the use of sodium hydrosulphite as a general reducing agent for azo dyes, the separation and isolation of the reduction products is somewhat simplified in comparison with the reduction method

wherein stannous chloride or tin and hydrochloric acid is used. However, if the procedure recommended by Fierz-David for the reduction by means of tin and hydrochloric acid is followed, the products of reduction may be isolated without contamination with salts of tin. This is accomplished by electrolysing the reduction solution in such a manner that the tin will be deposited on the copper cathode.

The tin-free hydrochloric acid solution of the reduction products is then filtered, if insoluble material is present, and this material examined for reduction products. The filtrate of the original solution, if it is clear, is next evaporated to dryness, *in vacuo*. The residue may then be either crystallised in fractions, or first distilled with steam, so that volatile amines, such as aniline, toluidines, xylidines, anisidines, α-naphthylamine, etc. will be separated from non-volatile products.

Non-volatile amines may either be extracted with ether or thrown out of solution as their sparingly soluble sulphates; such amines are benzidine, tolidine, dianisidine, diaminodiphenylamine, 1:4-diaminonaphthalene. Diamines of the type of *m*- and *p*-phenylenediamine, toluylene diamines and triamines are best isolated by extraction with ether. Reduction products which are sulphonic acid derivatives of amines, amino-phenols or amino-naphthols must be isolated by means of fractional crystallisation or precipitation and then further purified for identification. Many of these products give characteristic colour reactions in aqueous solution on filter paper when spotted with ammonia and with acids and reagents such as ferric chloride.

Information of this character has recently been recorded for a great many of the naphthalene reduction products by Forster and Hanson. (*J. Soc. Dyers & Col.*, 1926, **40**, 272.)

Certain derivatives of the amino-compounds may be used for identifying them. Of special utility in this connection may be mentioned acyl derivatives of amino compounds obtained by the use of acetyl chloride, benzoyl chloride, picryl chloride, benzene-sulphonyl chloride and additive compounds with picric acid, chloroplatinic acid, aryl nitro compounds (Ludborough, *J. Ind. Inst. Sci.*, 1921, **4**, 159). Arylamines may also be identified by examination of the azo dyes produced by coupling with β-naphthol and the anilide of β-oxynaphthoic acid. Information of this character

has been recorded by Rowe and Levin (*J. Soc. Dyers & Col.*, 1924, **40**, 218).

It is difficult to work out a general scheme for the separation and identification of the reduction mixture, because each azo dye, after being transformed into its reduction products, presents an individual problem in itself and should be analysed from this point of view.

The following lists give the reduction products obtainable from the more important commercial colouring matters. Under each reduction product are given the dyes from which it is obtained, together with any other reduction products that may be expected to be formed with it.

Reduction Products of Azo Dyes and the Dyes from Which They Are Obtained

The number on the left is the "Colour Index" number, and the one in parenthesis the "Schultz" number.

	Dye	Other reduction products
1-Alkylamino-7-amino-8-naphthol-3.6-disulphonic Acid		
206 (185)	Anthracene Chrome Black F.	2.3-amino naphthol-6-sulphonic acid
Amino-aceto-acetic-anilide		
648	Dianil Yellow 3GN..........	primuline-sulphonic acid
Amino-aceto-acetic-ester		
647 (25)	Dianil Yellow 3G............	primuline-sulphonic acid
6-Amino-2-amino (3-aminobenzoyl)-5-naphthol-7-sulphonic Acid		
324a	Rosanthrene O..............	aniline
1-Aminobenzene-3-sulphonic Acid (Metanilic Acid)		
138 (134)	Metanil Yellow.............	4-aminodiphenylamine
141	Phenoflavine................	1.4-diamino-2-phenol-5-sulphonic acid
233 (210)	Cotton Orange R............	primuline: 1.2.3.5-tetraminobenzene-4-6-disulphonic acid
289 (257)	Fast Cyanine 5R (TC).......	1.4-diaminonaphthalene: 4-amino-1-*p*-tolylnaphthyl-amine-8-sulphonic acid
290 (258)	Naphthalene Acid Black 4B..	1.4-diaminonaphthalene: 1.4-diamino-naphthalene-6 or 7-sulphonic acid
367	Congo GR..................	Benzidine: 1.2-diaminonaphthalene-4-sulphonic acid
1-Aminobenzene-4-sulphonic Acid (Sulphanilic Acid)		
16 (137)	Fast Yellow, Acid Yellow....	1.4-diaminobenzene-2-sulphonic acid
142 (138)	Orange III.................	4-amino-dimethylaniline
143 (139)	Orange IV..................	4-amino-diphenylamine
144 (142)	Curcumine..................	4-amino-diphenylamine sulphonic acid
145 (140)	Indian Yellow R............	2.4-, 2.4'-, and 4.4'-diamino-diphenylamines
146 (141)	Indian Yellow G............	2.2:4-, 2.4.4-', triamino-diphenylamines: 2.4.2'.4'- tetramino-diphenylamine
147	Azo Flavine FF.............	2.4.4'-triamino-diphenylamine
148 (143)	Chrysoin...................	1-amino-2.4-dihydroxybenzene
149	New Fast Yellow R.........	3-chlor-1.2.4-triaminobenzene-6-sulpho acid
150 (144)	Orange I....................	2-amino-1-naphthol
151 (145)	Orange II..................	1-amino-2-naphthol
153 (146)	Fast Fuchsine G............	7-amino-1.8-dihydroxynaphthalene-4-sulphonic acid
155	Quinazole Yellow...........	4-amino-1.3-dihydroxyquinoline
234 (211)	Resorcine Brown B (TC).....	2.4-diamino-1.3-dihydroxybenzene: *m*-xylidine
238 (221)	Anthracene Acid Brown R...	1.4-diaminobenzene: 3.5-diamino-2-hydroxybenzoic acid
239 (212)	Fast Brown G...............	2.4-diamino-1-naphthol
241 (220)	Wool Black 4B	1-naphthylamine: 1.2.7-triamin -8-naphthol-4-sulphonic acid
273	Benzo Brown D3G...........	1.4-diaminobenzene: 1.2.4-triaminobenzene
274 (250)	Milling Orange..............	1.4-diaminobenzene: 5-amino-2-hydroxybenzoic acid
275 (246)	Cloth Scarlet G (TC)........	1.4-diaminobenzene: 1-amino-2-naphthol
276 (248)	Fast Scarlet B..............	1.4-diaminobenzene: 1-amino-2-naphthol-6-sulphonic acid
277 (249)	Croceine Scarlet 3B.........	1.4-diaminobenzene: 1-amino-2-naphthol-8-sulphonic acid
278	Benzo Fast Red 8BL........	1.4-diaminobenzene: 2-benzoylamino-6-amino-5-naphthol-7-sulphonic acid
279	Wool Black.................	1.4-diaminobenzene-2-sulphonic acid: 1-amino-2-*p*-tolylnaphthylamine
280 (247)	Scarlet EC (TC)............	1.4-diaminobenzene-2-sulphonic acid: 1-amino-2-naphthol
281 (251)	Croceine Scarlet OX........	1.4-diaminobenzene-2-sulphonic acid: 1-amino-2-naphthol-8-sulphonic acid
282	Ponceau SX................	1.4-diaminobenzene-2-sulphonic acid: 1-amino-2-naphthol-3.6-disulphonic acid

	Dye	Other reduction products
1-Aminobenzene-4-sulphonic Acid (Sulphonic Acid)—*Continued.*		
291 (259)	Ponceau 10RB	2.5-diamino-anisole: 1-amino-2-naphthol-8-sulphonic acid
292 (260)	Eriochrome Verdone A	2.5-diamino-4-cresol: 1-amino-2-naphthol
293	Fast Violet R	1.4-diaminonaphthalene: 1-amino-2-naphthol-6-sulphonic acid
294 (261)	Acid Black 10B (TC)	1.4-diaminonaphthalene: 1.7-diamino-8-naphthol-3.6-disulphonic acid
295 (262)	Victoria Black B	1.4-diaminonaphthalene: 7-amino-1.8-dihydroxynaphthalene-4-sulphonic acid
322	Diamine Azo Scarlet	6-amino-7-sulpho-5-hydroxy-(3-aminophenyl)-1.2-naphthiminazole
323	Diamine Azo Orange 2R	4-amino-6-sulpho-3-hydroxy-(3-aminophenyl)-1.2-naphthiminazole
585 (466)	Eboli Green CW	Benzidine: 1.2.7-triamino-8-naphthol-3.6-disulphonic acid: 5-amino-2-hydroxybenzoic acid
596 (476)	Direct Brown 3GO (TC)	Benzidine: 1.2.4.5-tetraminobenzene: 5-amino-2-hydroxybenzoic acid
598 (477)	Congo Brown G (TC)	Benzidine: 2.4-diamino-1.3-dihydroxybenzene: 5-amino-2-hydroxybenzoic acid
599 (478)	Direct Green CO	Benzidine: 1.2.7-triamino-8-naphthol-4-sulphonic acid: 5-amino-2-hydroxybenzoic acid
606 (485)	Direct Brown G (TC)	1.3-diaminobenzene: 1.2.4.5-tetraminobenzene
610 (489)	Hessian Brown BBN	Benzidine: 2.4-diamino-1.3-dihydroxybenzene
611	Hessian Brown MM	*o*-tolidine: 2.4-diamino-1.3-dihydroxybenzene
640 (33)	Tartrazine (TC)	4-amino-1-(4-sulphobenzene)-5-pyrazolone-3-carboxylic acid
2-Amino Benzoic Acid		
211	Methyl Red	4-aminodimethylaniline
212	Palatine Chrome Bordeaux B.	3-amino-4-cresol
213	Diamond Yellow R	5-amino-2-hydroxybenzoic acid
214 (200)	Lake Red D	1-amino-2-naphthol
215 (201)	Pigment Scarlet G	1-amino-2-naphthol-6-sulphonic acid
216 (202)	Chrome Red B (TC)	1-amino-2-naphthol-3.6-disulphonic acid
3-Amino Benzoic Acid		
217 (203)	Yellow Fast to Soap	4-aminodiphenylamine
218 (204)	Diamond Yellow G	5-amino-2-hydroxybenzoic acid
349	Benzo Light Yellow 4CL	4.4 -diamino-2.2′-dimethoxydiphenylurea
607 (486)	Direct Brown J	1.3-diaminobenzene: 1.2.4.5-tetraminobenzene
3-Aminobenzoyl-3-aminobenzoyl-2-amino-5-naphthol-6-amino-7-sulphonic Acid		
324	Diazo Brilliant Scarlet	aniline
4-Amino-4 -benzoylamino-2.2 -ditolyl		
111 (104)	Benzoyl Pink	2-amino-1-naphthol-4-sulphonic acid
4-Amino-benzyl-diethylamine		
536 (435)	Janus Brown R	1.4-diaminonaphthalene: 1.2.4.5-tetraminobenzene: aniline
4-Amino-benzyl-dimethylamine		
71 (75)	New Phosphine G	1-amino-2.4-dihydroxybenzene
72 (74)	Tannin Orange R	1-amino-2-naphthol
4-Amino-1-(4-chloro-2-sulpho Benzene)-3-methyl-5-pyrazolone		
642	Polar Yellow 5G	4-aminophenol: toluene-4-sulphonic acid
4-Amino-1-(1-chloro-4-sulpho-2-methylbenzene)-3-methyl-5-pyrazolone		
643 (30)	Radial Yellow G	3-chloro-2-toluidine-5-sulphonic acid
Amino Cresol (MXT)		
374 (311)	Orange TA	Benzidine: 1.2-diaminonaphthalene-4-sulphonic acid
3-Amino-4-cresol		
104	Metachrome Olive Brown G.	1.3.5-triamino-2-phenol
212	Palatine Chrome Bordeaux B.	2-aminobenzoic acid
4-Amino-2-cresol		
103	Metachrome Brown Y	1.3.5-triamino-2-phenol

	Dye	Other reduction products
5-Amino-2-cresol-3-carboxylic Acid		
411 (351)	Cresotine Yellow G (TC).....	benzidine
442	Chromocitronine RR........	benzidine-2.2-disulphonic acid
478 (392)	Toluylene Orange G.........	o-tolidine: 2.4.5-triaminotoluene-6-sulphonic acid
481 (395)	Chrysamine Yellow R........	o-tolidine
3-Amino-4-cresol Methyl Ether		
119 (100)	Eosamine B, G..............	2-amino-1-naphthol-3.8-disulphonic acid
120 (101)	Coccinine B................	1-amino-2-naphthol-3.6-disulphonic acid
3-Amino-4-cresol-5 or 6-sulphonic Acid		
173	Metachrome Violet B........	1-amino-2-naphthol
2-Amino-4.6-dichlorophenol		
97 (86)	Azarine S..................	1-amino-2-naphthol
4-Amino-1-(2.4-dichlor-4-sulphobenzene)-3-methyl-5-pyrazolone		
639 (22)	Xylene Light Yellow 2G.....	4-toluidine-3-sulpho acid
4-Amino-diethylaniline-3-sulphonic Acid		
50 (59)	Wool Violet S..............	1.2.4-triaminobenzene
1-Amino-2.4-dihydroxybenzene		
23 (35)	Sudan G....................	aniline
51 (60)	Azo Phosphine GO...........	3-amino-dimethylaminobenzene
71 (75)	New Phosphine G............	amino-benzyl-dimethylamine
148 (143)	Resorcine Yellow (TC).......	1-aminobenzene-4-sulphonic acid
168 (155)	Acid Chrome Garnet R (TC).	2-aminophenol-4-sulphonic acid
380 (317)	Pyramidol Brown BG........	benzidine
412	Cloth Orange...............	benzidine: 5-amino-2-hydroxybenzoic acid
460 (374)	Congo Orange 4R...........	o-tolidine: 1.2-diaminonaphthalene-4-sulphonic acid
462 (376)	Pyramidol Brown T.........	o-tolidine
540 (437)	Isodiphenyl Black R.........	1.2.4-triaminobenzene: 2.7-diamino-8-naphthol-4-sulphonic acid
542	Para Bronze NB............	1.3-diaminobenzene: 1.7-diamino-8-naphthol-3.6-disulphonic acid
543	Diamine Fast Bordeaux......	1.3-diaminobenzene: 2.6-diamine-5-naphthol-7-sulphonic acid
565	Oxamine Red MT............	o-tolidine: 2.4.5-triaminotoluene (mono-oxamic acid)
3-Amino-4.6-dihydroxy Benzoic Acid		
37 (49)	Prague Alizarine Yellow G...	1.3-diamino-benzene
41	Prague Alizarine Yellow R...	1.4-diamino-benzene
8-Amino-1.7-dihydroxy-2-carboxynaphthalene-4-sulphonic Acid		
482 (396)	Indazurine RM.............	2-amino-1-naphthol-4-sulphonic acid: o-tolidine
485 (399)	Indazurine TS..............	o-tolidine: 2.7-diamino-8-naphthol-6-sulphonic acid
522 (427)	Indazurine GM.............	Dianisidine: 2-amino-1-naphthol-4-sulphonic acid
524 (429)	Indazurine BB..............	dianisidine: 1-amino-2-naphthol-3.6-disulphonic acid
525 (430)	Indazurine 5GM............	dianisidine: 1.7-diamino-8-naphthol-3.6-disulphonic acid
8-Amino-1.7-dihydroxy-6-carboxynaphthalene 3 sulphonic Acid		
484 (397)	Direct Blue R..............	o-tolidine: 2-amino-1-naphthol-4-sulphonic acid
486 (398)	Direct Grey B..............	o-tolidine
523 (428)	Direct Blue B...............	dianisidine: 2-amino-1-naphthol-4-sulphonic acid
1-Amino-2.7-dihydroxynaphthalene		
4 (3)	Gambine B..................	
414	Cloth Brown G..............	benzidine: 5-amino-2-hydroxybenzoic acid
2-Amino-1.5-dihydroxynaphthalene		
170 (157)	Chrome Black PV (TC)......	2-aminophenol-4-sulphonic acid
2-Amino-1.8-dihydroxy-naphthalene-3.6-disulphonic acid		
29 (40)	Chromotrope 2R............	aniline
45 (57)	Chromotrope 2B............	1.4-diaminobenzene (p-nitraniline)
53 (61)	Victoria Violet 4BS..........	1.4-diaminobenzene
56 (67)	Chromotrope 6B............	1.4-diaminobenzene, acetic acid
90 (114)	Chromotrope 10B...........	1-naphthylamine

	Dye	Other reduction products
2-Amino-1.8-dihydroxy-naphthalene-3.6-disulphonic Acid—*Continued.*		
100 (87)	Peri Wool Blue B, G	diamino-2-phenols
188 (171)	Chromotrope 8B	1-naphthylamine-4-sulphonic acid
342 (292)	Azo Alizarine Black I	1.4-diaminobenzene: 5-amino-2-hydroxybenzoic acid
389	Dianil Blue 4R	benzidine: 1-amino-2-naphthol-6-sulphonic acid
390 (323)	Dianil Blue R	benzidine
465 (379)	Benzo New Blue 2B	o-tolidine: 2-amino-1-naphthol-4-sulphonic acid
466 (380)	Dianil Blue B	o-tolidine
508 (415)	Dianil Blue G	dianisidine:
7-Amino-1.8-dihydroxynaphthalene-4-sulphonic Acid		
59 (63)	Azo Acid Blue B	4-amino-dimethylaniline
66 (71)	Azo Fuchsine B	o- and p-toluidine
153 (146)	Fast Fuchsine G	1-aminobenzene-4-sulphonic acid
255 (229)	Azo Acid Violet BX	aniline: 1.4-diaminobenzene
271 (242)	Sulphone Black G	aniline: 1.4-diaminonaphthalene-6 or 7-sulphonic acid
295 (262)	Victoria Black B	1-aminobenzene-4-sulphonic acid: 1.4-diaminonaphthalene
302 (276)	Diamond Green B	1.4-diaminonaphthalene: 5-amino-2-hydroxybenzoic acid
500 (416)	Brilliant Azurine 5G	Dianisidine
568 (452)	Benzo Indigo Blue	o-tolidine: 1.4-diaminonaphthalene
579 (460)	Benzo Black Blue 5G	benzidine-3.3-disulphonic acid: 1.4-diaminonaphthalene
8-Amino-1.7-dihydroxynaphthalene-4-sulphonic Acid		
506 (413)	Direct Violet BB	dianisidine: 2.4.5-triaminotoluene
507 (414)	Indazurine B	dianisidine: 1-amin-2-naphthol-3.6-disulphonic acid
4-amino-1.3-dihydroxy-quinoline		
155	Quinazole Yellow	1-aminobenzene-4-sulphonic acid
4-Amino-dimethylaniline		
19 (32)	Butter Yellow (TC)	aniline
58 (62)	Azo Galleine	amino-2.4.5-trioxybenzene
59 (63)	Azo Acid Blue B	7-amino-1.8-dioxynaphthalene-4-sulphonic acid
133 (124)	Janus Green B	Safranine
142 (138)	Orange III	1-aminobenzene-4-sulphonic acid
211	Methyl Red	2-aminobenzoic acid
265 (239)	Azotol C	1.4-diaminobenzene: 1-amino-2-naphthol
4-Amino-diphenylamine		
138 (134)	Metanil Yellow	1-aminobenzene-3-sulphonic acid
143 (139)	Orange IV	1-aminobenzene-4-sulphonic acid
162 (150)	Fast Yellow N	4-toluidine-2-sulphonic acid
4-Amino-diphenylamine-2-sulphonic Acid		
144 (142)	Curcumine	1-aminobenzene-4-sulphonic acid
304	Fast Acid Black N2B (TC)	1.4-diaminonaphthalene: 4-amino-1-naphthol-6-sulphonic acid
305	Nerol B	1.4-diaminonaphthalene: 1-amino-2-naphthol-3.6-disulphonic acid
4-Amino-1.3-diphenyldiaminobenzene		
309 (267)	Anthracite Black B	1.4-diaminonaphthalene: 1-naphthalamine-3.6-disulphonic acid
4-Amino-1-ethyl-benzyl-aniline-(4-sulphonic Acid)		
42 (50)	Azo Cardinal G	1.4-Diaminobenzene
4-Amino-1-ethylnaphthylamine		
207 (186)	Lanacyl Violet B	1.8-aminonaphthol-3.6-disulphonic acid
1-Amino-2-ethylnaphthylamine-7-sulphonic Acid		
257 (231)	Cloth Red 3B	2-toluidine: 2.5-diaminotoluene
5-Amino-2-hydroxy benzoic Acid		
36 (48)	Chrome Yellow GG (TC)	1.3-diaminobenzene
40 (58)	Chrome Yellow R (TC)	1.4-diaminobenzene
52	Azo Alizarine Yellow GP	1.4-diaminobenzene: acetic acid
109 (103)	Mordant Yellow GRO	benzidine
110 (102)	Diamond Flavine G	4-amino-4′-hydroxy-diphenyl
112 (96)	Chrome Fast Yellow 2G	2-anisidine

	Dye	Other reduction products
5-Amino-2-hydroxy Benzoic Acid—*Continued.*		
122	Erio Chrome Yellow 6G......	4-phenetidine
157 (133)	Eriochrome Phosphine R.....	1.4-diaminobenzene-2-sulphonic acid
195 (177)	Mordant Yellow (TC).......	2-naphthylamine-6-sulphonic acid
197 (178)	Solochrome Yellow Y........	2-naphthylamine-6.8-disulphonic acid
213	Diamond Yellow R..........	2-aminobenzoic acid
218 (204)	Diamond Yellow G..........	3-aminobenzoic acid
219	Eriochrome Flavine A.......	
223 (199)	Cotton Yellow R............	Dehydrothio-*p*-toluidine-sulphonic acid
274 (250)	Milling Orange..............	1.4-diaminobenzene: 1.aminobenzene-4-sulphonic acid
299 (275)	Chrome Black F (TC).......	1.4-diaminonaphthalene: 2-amino-1-naphthol-5-sulphonic acid
302 (276)	Diamond Green B...........	1.4-diaminonaphthalene: 7-amino-1.8-dihydroxynaphthalene-4-sulphonic acid
303 (277)	Anthracene Acid Black.......	1.4-diaminonaphthalene-6 or 7-sulphonic acid 1-amino-2-naphthol-3.6-disulphonic acid
340	Chrome Red S..............	1.4-diaminobenzene: 1.2-diaminonaphthalene-6-sulphonic acid
341 (291)	Azo Alizarine Bordeaux W...	1.4-diaminobenzene: 2-amino-1-naphthol-4-sulphonic acid
342 (292)	Azo Alizarine Black I........	1.4-diaminobenzene: 2-amino-1.8-dihydroxynaphthalene-3.6-disulphonic acid
343 (294)	Anthracene Yellow C........	4.4-diamino thio diphenyl
346 (296)	Chlorazol Fast Yellow 5GK..	4.4-diaminodiphenylurea
366 (305)	Hessian Yellow.............	4.4-diamino-2.2-disulpho-stilbene
409 (339)	Brilliant Orange G..........	benzidine: 2.5-diaminophenol-4-sulphonic acid
410 (342)	Chrysamine G (TC).........	benzidine
412	Cloth Orange...............	benzidine: 1-amino-2.4-dihydroxybenzene
413	Cloth Brown R.............	benzidine; 2-amino-1-naphthol-4-sulphonic acid
414	Cloth Brown G.............	benzidine: 1-amino-2.7-dihydroxynaphthalene
415 (340)	Direct Orange R (TC).......	benzidine: 1.2-diaminonaphthalene-4-sulphonic acid
417 (341)	Crumpsall Direct Fast Red R.	benzidines: 1-amino-2-naphthol-3.6-di-sulphonic acid
416 (341)	Chlorazol Orange 2R........	benzidine 1-amino-2-naphthol-3.6-di-sulphonic acid
418	Diamine Nitrazol G.........	benzidine: 1.7-diamino-8-naph hol-4.6-disulphonic acid
419 (343)	Direct Fast Red F (TC).....	benzidine: 1 2-diamino-8-naphthol-6-sulphonic acid
420 (344)	Direct Brown M (TC).......	benzidine: 2.7-diamino-8-naphthol-6-sulphonic acid
421 (347)	Diphenyl Brown RN.........	benzidine: 2-methylamino-7-amino-8-naphthol-6-sulphonic acid
422 (348)	Diphenyl Brown BN.........	benzidine: 2-dimethylamino-7-amino-8-naphthol-6-sulphonic acid
423 (349)	Chlorazol Brown B..........	benzidine: 2-phenylamino-7-amino-8-naphthol-6-sulphonic acid
424 (345)	Oxamine Maroon...........	benzidine: 1.6-diamino-5-naphthol-7-sulphonic acid
425 (346)	Oxamine Red..............	benzidine: 2.6-diamino-5-naphthol-7-sulphonic acid
426 (350)	Alkali Yellow R............	benzidine: dehydro thio-*p*-toluidine
431 (355)	Anthracene Red I..........	3.4.4′-triaminodiphenyl: 2-amino-1-naphthol-4-sulphonic acid
432	Salicine Red B.............	3.4.4′-triaminodiphenyl: 1-amino-2-naphthol
433	Salicine Yellow G..........	3.4.4′-triaminodiphenyl
441	Chromazol Yellow CR.......	benzidine-2.2-disulphonic acid
445	Carbazole Yellow...........	diamino-carbazole
479 (393)	Diphenyl Brown 3GN.......	*o*-tolidine: 2-dimethylamino-7-amino-8-naphthol-6-sulphonic acid
480 (394)	Chrysamine R..............	*o*-tolidine
488 (404)	Diamine Yellow N..........	3-ethoxybenzidine: 4-phenetidine
531	Chrome Patent Green A.....	aniline: 1.2.7-triamino-8-naphthol-4.6-disulphonic acid: 1.4-diaminonaphthalene

	Dye	Other reduction products
5-Amino-2-hydroxy Benzoic Acid—*Continued.*		
555 (444)	Crumpsall Direct Fast Brown B	benzidine: 2.5-diamino-1.4-dimethylbenzene: 2.7-diamino-8-naphthol-6-sulphonic acid
556 (445)	Crumpsall Direct Fast Brown O	benzidine: 2.5-diamino-1.4-dimethylbenzene: 2-phenyl-amino-7-amino-8-naphthol-6-sulphonic acid
557 (447)	Benzo Grey S	benzidine: 1.4-diaminonaphthalene: 2-amino-1-naphthol-4-sulphonic acid
558 (446)	Benzo Olive	benzidine: 1.4-diaminonaphthalene: 1.7-diamino-8-naphthol-3.6-disulphonic acid
559 (448)	Diamine Bronze G	benzidine: 1.7-diamino-8-naphthol-3.6-disulphonic acid: 1.2.4-triaminobenzene
560	Cotton Dark Brown T	benzidine: 2.7-diamino-8-naphthol-6-sulphonic acid: 1.2.4-triaminobenzene: 2.7-diamino-8-naphthol-6-sulphonic acid
561 (449)	Chlorazol Brown LF	benizdine: 2.7-diamino-8-naphthol-6-sulphuonic acid: 1-naphthylamine-4-sulphonic acid: 2.3.4.5-tetraminotoluene
570 (454)	Trisulphone Brown G	o-tolidine: 2.7-diamino-8-naphthol-3.6-disulphonic acid: 1-naphthylamine-4-sulphonic acid: 2.3.4.5-tetraminotoluene
577 (457)	Trisulphone Brown 2G	dianisidine: 2.7-diamino-8-naphthol-3.6-disulphonic acid: 1-naphthylamine-4-sulphonic acid: 2.3.4.5-tetraminotoluene
585 (466)	Eboli Green CW	benzidine: 1.2.7-triamino-8-naphthol-3.6-disulphonic acid: 1-aminobenzene-4-sulphonic acid
587 (468)	Diphenyl Green 3G	benzidine: 1.2.7-triamino-8-naphthol-3.6-disulphonic acid: 1:4-diamino-2-chlorbenzene
589 (470)	Chloramine Green B (TC)	benzidine: 1.2.7-triamino-8-naphthol-3.6-dis lphonic acid: 2.5-chloraniline
594 (475)	Direct Green G (TC)	benzidine: 1.2.7-triamino-8-naphthol-3.6-disulphonic acid: 1.4-diaminobenzene
595	Diazo Olive G	benzidine: 1.2.7-triamino-8-naphthol-4-sulphonic acid: 1.4-diaminobenzene
596 (476)	Direct Brown 3GO (TC)	benzidine: 1.2.4.5-tetraminobenzene: 1-aminobenzene-4-sulphonic acid
597	Dianil Chrome Brown R	benzidine: 1.2.4.5-tetraminobenzene: 1-naphthylamine-4-sulphonic acid
598 (477)	Congo Brown G (TC)	benzidine: 1-aminobenzene-4-sulphonic acid: 2.4-diamino-1.3-dihydroxybenzoic acid
599 (478)	Direct Green CO	benzidine: 1-aminobenzene-4-sulphonic acid: 1.2.7-triamino-8-naphthol-4-sulphonic acid
601 (480)	Congo Brown R	benzidine: 1-naphthylamine-5-sulphonic acid: 2.4-diamino-1.3-dihydroxybenzene
618 (492)	Anthracene Acid Brown B	1.2.4.5-tetraminobenzene: 1.4-diaminonaphthalene-4-sulphonic acid
653	Pyrazol Orange G	benzidine: 4-amino-1-(4-sulphobenzene)-5-pyrazolone-3-carboxylic acid
4-Amino-4-hydroxy-diphenyl		
110 (102)	Diamond Flavine G	5-amino-2-hydroxybenzoic acid
5-Amino-2-hydroxy-3-sulphobenzoic Acid		
301	Chrome Black I	1.4-diaminonaphthalene: 2-amino-1-naphthol-4-sulphonic acid
Amino-α-methy Ketol		
532	Diazo Fast Green BL	2.7-diamino-8-naphthol-6-sulphonic acid: 1.4-diaminonaphthalene-6-sulphonic acid
2-Amino-1-naphthol		
3	Gambine R	
4-Amino-1-naphthol		
81 (105)	Pigment Brown	1.-naphthylamine
150 (144)	Orange I (TC)	1-aminobenzene-4-sulphonic acid
175 (160)	Acid Brown R	1-naphthylamine-4-sulphonic acid

	Dye	Other reduction products
4-Amino-1-naphthol—*Continued.*		
192 (172)	Fast Brown 3B............	2-naphthylamine-6-sulphonic acid
201 (180)	Chrome Blue Black B (TC)..	1-amino-2-naphthol-4-sulphonic acid
203 (183)	Chrome Black T (TC).......	1.5-diamino-2-naphthol-4-sulphonic acid
1-Amino-2-naphthol		
2 (2)	Gambine..................	
24 (36)	Sudan I (TC)..............	aniline
38 (46)	*m*-Nitraniline Orange (on the Fibre).................	1-3-diaminobenzene
44 (56)	Para Red..................	1.4-diaminobenzene
68 (72)	Pigment Orange R..........	2.4-diaminotoluene or 4-nitro-2-toluidine (partial reduction)
69 (73)	Toluidine Red RL (TC)......	3.4-diaminotoluene or 3-nitro-4-toluidine (partial reduction)
72 (74)	Tannin Orange R...........	amino benzyl-dimethyl amine
73 (76)	Sudan II (TC)..............	Xylidines (mxt)
82 (106)	Naphthylamine Claret.......	1-naphthylamine
83 (107)	Naphthine Brown A.........	1-naphthylamine
93 (115)	Azo Turkish Red...........	2-naphthylamine
94 (116)	Naphthine Brown B.........	2-naphthylamine
97 (86)	Azarine S.................	2.amino-4.6-dichlorophenol
113 (93)	Sudan R..................	2-anisidine
116 (97)	Chloranisidine Scarlet.......	4-chlor-2-amino-anisole
117 (98)	Nitrosamine Pink BX........	2.5-diamino-anisole
118 (99)	Tuscaline Orange G.........	2.4-diamino-anisole
123	Nitrophenetidine Red........	3.4-diamino-phenetole
135 (126)	Janus Blue G, R............	Safranine
151 (145)	Orange II (TC)............	1-aminobenzene-4-sulphonic acid
156 (131)	Permanent Orange R........	3-chloraniine-6-sulphonic acid
158 (132)	Lake Red P................	1.4-diaminobenzene-2-sulphonic acid
159 (148)	Fast Orange O.............	1.2-diaminobenzene-4-sulphonic acid
161 (151)	Orange R (TC).............	2-toluidine-5-sulphonic acid
165 (153)	Lake Red C (TC)...........	2-chlor-5-toluidine-4-sulphonic acid
169 (156)	Chrome Violet B (TC).......	2-aminophenol-4-sulphonic acid 6-nitro-2-amidophenol-4-sulphonic acid- (partial reduction)
172 (159)	Acid Alizarine Black R.......	2-6-diaminophenol-4-sulphonic acid
173	Metachrome Violet B........	3-amino-4-cresol-5 or 6-sulphonic acid
176 (161)	Fast Red A (TC)...........	1-naphthylamine-4-sulphonic acid
177 (162)	Brilliant Fast Red G........	1-naphthylamine-5-sulphonic acid
189 (173)	Lithol Red R (TC)..........	2-naphthylamine-1-sulphonic acid
193 (174)	Double Brilliant Scarlet G....	2-naphthylamine-6-sulphonic acid
196 (175)	Acid Ponceau DH..........	2-naphthylamine-5- and -8-sulphonic acid
202 (181)	Chrome Blue Black U (TC)..	1-amino-2-naphthol-4-sulphonic acid
204 (184)	Chrome Black A (TC).......	1.5-diamino-2-naphthol-4-sulphonic acid
214 (200)	Lake Red D................	2-aminobenzoic acid
224 (193)	Clayton Cloth Red..........	Dehydrothio-*p*-toluidine sulphonic acid
248 (223)	Oil Scarlet LB.............	aniline: 1.4-diaminobenzene
258 (232)	Sudan IV (TC).............	2-toluidine: 2.5-diaminotoluene
265 (239)	Azotol C..................	1.4-diaminobenzene: 4-amino-1-dimethylaminobenzene
266 (240)	Janus Red B...............	2.5-diaminotoluene: 3-aminophenyl-trimethyl-ammonium chloride
272	Granite Black..............	1.3.5-triamino-2-phenol: 1.4-diaminonaphthalene-6 or 7-sulphonic acid
275 (246)	Cloth Scarlet G (TC)........	1.4-diaminobenzene: 1-aminobenzene-4-sulphonic acid
280 (247)	Scarlet EC (TC)............	1.4-diaminobenzene-2-sulphonic acid: 1-aminobenzene-4-sulphonic acid
283 (252)	Cloth Scarlet R............	2.5-diaminotoluene: 2-toluidine-5-sulphonic acid
287	Bordeaux BX..............	*m*-4-xylidine-5-sulphonic acid
292 (260)	Eriochrome Verdone A.......	2.5-diamino-4-cresol: 1-aminobenzene-4-sulphonic acid
292 (260)	Eriochrome Verdone S.......	2.5-diamino-4-cresol: 4-chloraniline-2-sulphonic acid
306 (264)	Fast Acid Black F..........	1-naphthylamine-4-sulphonic acid: 1.7-diamino-8-naphthol-3.6-disulphonic acid
314 (271)	Diamine Blue 6G..........	2-naphthylamine-6.8-disulphonic acid: 1.4-diamino-2-ethoxynaphthalene

	Dye	Other reduction products
1-Amino-2-naphthol—*Continued.*		
336 (288)	Acid Alizarine Black SE......	2.6-diaminophenol-4-sulphonic acid
337 (289)	Acid Alizarine Black SN.....	2.6-diaminophenol-4-sulphonic acid: 1-amino-2-naphthol-6-sulphonic acid
363	Hessian Violet.............	4.4-diamino 2.2-disulpho-stilbene: 1.4-diaminonaphthalene
381 (318)	Benzidine Puce............	benzidine
387 (322)	Direct Violet B (TC)........	benzidine: 2-amino-1-naphthol-3.6.8-trisulphonic acid
432	Salicine Red B.............	3.4.4′-triaminodiphenyl: 5-amino-2-hydroxybenzoic acid
443	Acid Anthracene Red G......	benzidine-2.2-disulphonic acid
464 (378)	Direct Blue R (TC).........	*o*-tolidine: 2-amino-1-naphthol-3.6.8-trisulphonic acid
487 (400)	Acid Anthracene Red 3B.....	*o*-tolidine-dilsulphonic acid
501 (409)	Trisulphone Blue B.........	Dianisidine: 2-amino-1-naphthol-3.6.8-trisulphonic acid
512 (419)	Direct Blue RW (TC).......	dianisidine: 1.7-diamino-8-naphthol-2.4-disulphonic acid
564	Oxamine Violet BBR........	*o*-tolidine: 2-amino-1-naphthol-4-sulphonic acid: 1.2.4-triaminobenzene
571	Oxamine Blue BB..........	Dianisidine: 2-amino-1-naphthol-4-sulphonic acid: 1.2.4-triaminobenzene
1-Amino-2-naphthol-3-carboxy-anilide		
70	Rapid Fast Red GL.........	3.4-diaminotoluene or 3-nitro-4-toluidine (partial reduction)
1.2-Aminonaphthol-3-carboxylic Acid		
35 (45)	Brilliant Lake Red R........	aniline
160	Hansa Rubine G...........	1.2.4-triaminobenzene-6-sulphonic acid
163 (152)	Permanent Red 4B..........	4-toluidine-3-sulphonic acid
166	Lithol Red 2G.............	2-chlor-5-toluidine-4-sulphonic acid
190 (179)	Lake Bordeaux B...........	2-naphthylamine-1-sulphonic acid
2-Amino-1-naphthol-8-chlor-3.6-disulphonic Acid		
128 (119)	Diamine Pink R...........	Dehydrothio-*p*-toluidine
511 (418)	Brilliant Azurine B.........	Dianisidine
2-Amino-1-naphthol-8-chlor-5-sulphonic Acid		
510 (417)	Chlorazol Brilliant Blue 8B...	Dianisidine
1-Amino-2-naphthol-3.6-disulphonic Acid		
28 (39)	Acid Orange R.............	aniline
39 (47)	Orange III................	1 3-diaminobenzene
55 (65)	Azo Coralline (TC).........	1.4-diaminobenzene
64	Ponceau RT...............	*o*-toluidine
79 (82)	Ponceau 2R (TC)..........	*m*-xylidine
80 (83)	Ponceau 3R (TC)..........	Cumidine (crude)
80 (83)	Ponceau 4R...............	1.2.4.5-Cumidine
88 (112)	Bordeaux B (TC)..........	1-naphthylamine
120 (101)	Coccinine B...............	3-amido-4-cresol methyl ether
184 (168)	Amaranth (TC)............	1-naphthylamine-4-sulphonic acid
200	Heliopurpurine 7BL.........	2-naphthylamine-1.6-disulphonic acid
216 (202)	Chrome Red B (TC).........	2-aminobenzoic acid
253	Ponceau SS (TC)...........	aniline: 1.4-diaminobenzene
262 (236)	Cloth Red 2B (TC).........	2-toluidine: 2.5-diaminotoluene
264 (238)	Union Fast Claret..........	*m*-xylidine: 4.5-diamino-1.3-dimethylbenzene
270 (244)	Coomassie Wool Black S.....	1.4-diaminobenzene: 1.4-diaminonaphthalene
282	Ponceau SX...............	1.4-diaminobenzene-2-sulphonic acid: 1-aminobenzene-4-sulphonic acid
303 (277)	Anthracene Acid Black......	1.4-diaminonaphthalene-6 or 7-sulphonic acid: 5-amino-2-hydroxybenzoic acid
305	Nerol B...................	1.4-diaminonaphthalene: 4-aminodiphenylamine-2-sulphonic acid
311 (269)	Naphthol Black............	1.4-diaminonaphthalene: 1-naphthylamine-4.6-(7)-disulphonic acid
312	Blue Black B..............	1.4-diaminonaphthalene: 2-naphthylamine-5- and -8-sulphonic acid
313 (270)	Brilliant Croceine 9B........	2.5-diaminotoluene: 2-naphthylamine-6.8-disulphonic acid: 1-amino-2-naphthol-6.8-disulphonic acid
315 (272)	Naphthol Black B...........	1.4-diaminonaphthalene: 2-naphthylamine-6.8-disulphonic acid

	Dye	Other reduction products
1-Amino-2-naphthol-3.6-disulphonic Acid—*Continued.*		
320	Biebrich Patent Black BO....	1.4-diaminonaphthalene-6(7)-sulphonic acid: 1-naphthylamine-3.6-disulphonic acid
354 (298)	Milling Red R..............	4.4-diaminodiphenylmethane
356 (299)	Cinnabar Scarlet BF.........	4.4-diamino2.2'.5.5'-tetramethyldiphenylmethane
357 (300)	Cotton Ponceau.............	4.4-diamino2.2'.5.5'-tetramethyltriphenylmethane
417 (341)	Crumpsall Direct Fast Red R	benzidine: 5-amino-2-2hydroxybenzoic acid
504 (412)	Congo Blue 2B..............	Dianisidine: 2-amino-1-naphthol-4-sulphonic acid
505	Titan Blue 3B..............	Dianisidine: 2-amino-1-naphthol-4.7-disulphoinc acid
507 (414)	Indazurine B...............	Dianisidine: 8-amino-1.7-dihydroxynaphthalene-4-sulphonic acid
524 (429)	Indazurine BB..............	Dianisidine: 8-amino-1.7-dihydroxynaphthalene-2-carboxynaphthalene-4-sulphonic acid
546	Oxamine Violet GRF........	benzidine: 1.2.4-triaminobenzene (mono-oxamic acid)
563	Oxamine Violet MT.........	*o*-tolidine: 1.2.4-triaminobenzene (mono-oxamic acid)
573	Oxamine Blue BT...........	dianisidine: 1.2.4-triaminobenzene and (mono-oxamic acid)
574	Oxamine Blue MD..........	dianisidine: 1.2.4-triaminobenzene (mono-oxaminc acid)
605 (484)	Milling Scarlet B............	2.4-diaminotoluene: 2-amino-1-naphthol-4-sulphonic acid
1-Amino-2-naphthol-3.7-disulphonic Acid		
491	Diamine Blue B.............	3-ethoxybenzidine: 2-amino-1-naphthol-4-sulphonic acid
492 (402)	Diamine Blue Black E.......	3-ethoxybenzidine: 2.7-diamino-8-naphthol-6-sulphonic acid
1-Amino-2-naphthol-6.8-disulphonic Acid		
27 (38)	Orange G (TC).............	aniline
89 (113)	Crystal Ponceau............	1-naphthylamine
131 (122)	Erika G Ex................	dehydrothio-*m*-xylidine
185 (169)	Cochineal Red (TC).........	1-naphthylamine-4-sulphonic acid
252 (227)	Brilliant Croceine (TC)......	aniline: 1.4-diaminobenzene
313 (270)	Brilliant Croceine 9B.......	2.5-diaminotoluene: 2-naphthylamine-6.8-disulphonic acid: 1-amino-2-naphthol-3.6-disulphonic acid
382 (319)	Diamine Scarlet B...........	benzidine: 4-phenetidine
382 (319)	Diamine Scarlet 3B.........	*o*-tolidine: 4-phenetidine
430	Polar Red B................	*o*-tolidine: 4-aminophenol: toluene-4-sulphonic acid
1.8-Amino-naphthol-3.6-disulphonic Acid (H-acid)		
207 (186)	Lanacyl Violet B...........	4-amino-1-ethylnaphthylamine
208 (188)	Fast Acid Blue R (TC)......	4-amino-1-phenylnaphthylamine-8-sulphonic acid
209 (189)	Sulphon Acid Blue B........	4-amino-1-*p*-tolyl naphthylamine-8-sulphonic acid
210 (187)	Lanacyl Blue BB............	4.5-diamino-1-naphthol
319	Brilliant Fast Blue B........	1.4-diaminonaphthalene: 2-phenylamino-6-amino-5-naphthol-7-sulphonic acid
2-Amino-1-naphthol-3.6-disulphonic Acid		
54 (64)	Kiton Red S................	1.4-diaminobenzene, acetic acid
77 (81)	Palatine Scarlet............	*m*-xylidine
85 (109)	Palatine Red A.............	1-naphthylamine
91	Palatine Scarlet 3R.........	2-naphthylamine
181 (165)	Azo Red A.................	1-naphthylamine-4-sulphonic acid
198	Heliopurpurine 4BL.........	2-naphthylamine-3.6-disulphonic acid
250 (225)	Croceine AZ...............	aniline: 1.4-diaminobenzene
388	Benzo Violet R.............	benzidine: 2-amino-1-naphthol-4-sulphonic acid
2-Amino-1-naphthol-3.8-disulphonic Acid		
119 (100)	Eosamine B, G.............	3-amido-4-cresol methyl ether
126 (117)	Erika 2GN.................	dehydrothio-*p*-toluidine

	Dye	Other reduction products
2-Amino-1 naphthol-3.8-disulphonic Acid—*Continued.*		
127 (118)	Geranine 2B	dehydrothio-*p*-toluidine
130 (121)	Erika B Ex	dehydrothio-*m*-xylidine
392 (325)	Columbia Blue R	benzidine: 1.7-diamino-8-naphthol-4-sulphonic acid
473 (387)	Columbia Blue G	*o*-tolidine: 1.7-diamino-8-naphthol-4-sulphonic acid
567 (451)	Congo Fast Blue R	*o*-tolidine: 1.4-diamino-naphthalene
576 (456)	Congo Fast Blue B	dianisidine: 1.4-diamino-naphthalene
2-Amino-1-naphthol-4.7-disulphonic Acid		
505	Titan Blue 3B	dianisidine: 1-amino-2-naphthol-3.6-disulphonic acid
2-Amino-1-naphthol-4.8-disulphonic Acid		
76 (80)	Wool Scarlet R	xylidines (mxt.)
86 (110)	Buffalo Rubine	1-naphthylamine
115 (95)	Azo Cochineal	2-anisidine
251 (226)	Croceine B	aniline: 1.4-diaminobenzene
260 (235)	Croceine 3B	2-toluidine: 2.5-diaminotoluene
386 (321)	Heliotrope 2B	benzidine: 1-amino-2-naphthol-8-sulphonic acid
2-Amino-1-naphthol-5.6-pheno-carbazol-3-sulphonic Acid		
65	Naphtamine Fast Scarlet	*o*-toluidine
1-Amino-2-naphthol-4-sulphonic Acid		
201 (180)	Chrome Blue Black B (TC)	4-amino-1-naphthol
202 (181)	Chrome Blue Black U (TC)	1-amino-2-naphthol
652 (29)	Eriochrome Red B	4-amino-1-phenyl-3-methyl-5-pyrazolone
1-Amino-2-naphthol-6-sulphonic Acid		
5 (4)	Naphthol Green (TC)	
26 (37)	Croceine Orange (TC)	aniline
63 (70)	Croceine Orange R	*o*-toluidine
78 (79)	Brilliant Orange R	xylidines (mxt)
87 (111)	Fast Red BT	1-naphthylamine
182 (166)	Fast Red E	1-naphthylamine-4-sulphonic acid
215 (201)	Pigment Scarlet G	2-aminobenzoic acid
226 (196)	Clayton Cloth Scarlet	dehydrothio-*p*-toluidine sulphonic acid
228 (197)	Direct Scarlet G (TC)	primuline
261 (234)	Cloth Red G	2-toluidine: 2.5-diaminotoluene
263 (237)	Bordeaux BX	*m*-xylidine: 4.5-diamino-1.3-dimenthylbenzene
269 (243)	Coomassie Wool Black R	1.4-diaminonaphthalene: 1.4-diaminobenzene
276 (248)	Fast Scarlet B	1.4-diaminobenzene: 1-aminobenzene-4-sulphonic acid
285 (254)	Bordeaux G	2.5-diaminotoluene: 2-toluidine-5-sulphonic acid
293	Fast Violet R	1.4-diaminonaphthalene: 1-aminobenzene-4-sulphonic acid
298	Fast Violet B	1.4-diaminonaphthalene: 4-toluidine-3-sulphonic acid
316 (273)	Diazo Indigo Blue B	1.4-diaminonaphthalene: 1.4-diaminonaphthalene-6(7)sulphonic acid
321	Diamine Fast Scarlet	aniline: 6-amino-7-sulpho-5-hydroxy-(3-aminophenyl)-1.2-naphthiminazole
337 (289)	Acid Alizarine Black SN	1-amino-2-naphthol: 2.6-diaminophenol-6-sulphonic acid
344 (293)	Milling Red G	4.4-diamino-thiodiphenyl
389	Dianil Blue 4R	benzidine: 2-amino-1.8-dihydroxynaphthalene-3.6-disulphonic acid
1-Amino-2-naphthol-8-sulphonic Acid		
183 (167)	Crocein Scarlet 3BX	1-naphthylamine-4-sulphonic acid
205	Ponceau 3R	2.7-diamino-8-naphthol-6-sulphonic acid
277 (249)	Croceine Scarlet 3B	1.4-diaminobenzene: 1-aminobenzene-4-sulphonic acid
281 (251)	Croceine Scarlet OX	1.4-diaminobenzene-2-sulphonic acid: 1-aminobenzene-4-sulphonic acid
286 (255)	Croceine Scarlet 8B	2.4-diaminotoluene: 2-toluidine-5-sulphonic acid
291 (259)	Ponceau 10RB	2.5-diaminoanisole: 1-aminobenzene-4-sulphonic acid

	Dye	Other reduction products
1-Amino-2-naphthol-8-sulphonic Acid—*Continued.*		
376 (313)	Congo Rubine	benzidine: 1.2-diaminonaphthalene-4-sulphonic acid
385 (320)	Bordeaux (TC)	benzidine
386 (321)	Heliotrope 2B	benzidine: 2-amino-1-naphthol-4.8-disulphonic acid
391 (324)	Chicago Blue 4R	benzidine: 1.7-diamino-8-naphthol-4-sulphonic acid
470 (384)	Chicago Blue 2R	*o*-tolidine: 1.7-diamino-8-naphthol-4-sulphonic acid
513 (420)	Azidine Wool Blue B	dianisidine: 1.7-diamino-8-naphthol-4-sulphonic acid
2-Amino-1-naphthol-3-sulphonic Acid		
127 (118)	Geranine 2B	dehydrothio-*p*-toluidine
2-Amino-1-naphthol-4-sulphonic Acid		
6	Naphthol Green G	
74 (77)	Azo Coccin 2R	xylidines (mxt.)
111 (104)	Benzoyl Pink	4-amino-4′-benzoylamino-2.2′-ditolyl
114 (94)	Azo Eosine G	2-anisidine
179 (163)	Azo Rubine (TC)	1-naphthylamine-4-sulphonic acid
191	Pyrotine RRO	2-naphthylamine-5-sulphonic acid
194 (176)	Double Brilliant Scarlet S	2-naphthylamine-6-sulphonic acid
225 (194)	Direct Pink R (TC)	dehydrothio-*p*-toluidine sulphonic acid
227 (195)	Direct Scarlet SG (TC)	primuline
249 (224)	Cloth Red G	aniline: 1.4-diaminobenzene
259 (233)	Cloth Red B (TC)	2-toluidine: 2.5-diaminotoluene
284 (253)	Orseilline BB	2.5-diaminotoluene: 2-toluidine-5-sulphonic acid
301	Chrome Black I	1.4-diaminonaphthelene: 5-amino-2-hydroxy-3-sulphobenzoic acid
338 (290)	Violet Black	1.4-diaminobenzene: 1.4-diaminonaphthalene
341 (291)	Azo Alizarine Bordeaux W	1.4-diaminobenzene: 5-amino-2-hydroxybenzoic acid
370 (307)	Congo Red (TC)	benzidine
375 (312)	Congo Corinth G (TC)	benzidine: 1.2-diaminonaphthalene-4-sulphonic acid
384	Oxamine Red B	benzidine: 1.2.4-triaminobenzene (mono oxamic acid)
388	Benzo Violet R	benzidine: 2-amino-1-naphthol-3.6-disulphonic acid
413	Cloth Brown R	benzidine: 5-amino-2-hydroxybenzoic acid
431 (355)	Anthracene Red I	3.4.4′-triamino-diphenyl: 5-amino-2-hydroxybenzoic acid
447	Oxamine Violet R	*o*-tolidine: 1.2.4-triaminobenzene
461 (375)	Congo Corinth B	*o*-tolidine: 1.2-diaminonaphthalene-4-sulphonic acid
463 (377)	Azo Blue	*o*-tolidine
465 (379)	Benzo New Blue 2B	*o*-tolidine: 2-amino-1.8-dihydroxynaphthalene-3.6-disulphonic acid
471 (385)	Benzoazurine 3R	*o*-tolidine: 2.6-diamino-5-naphthol-7-sulphonic acid
472 (386)	Direct Blue BX (TC)	*o*-tolidine: 1.7-diamino-8-naphthol-3.6-disulphonic acid
482 (396)	Indazurine RM	*o*-tolidine: 8-amino-1.7-dihydroxy-2-carboxynaphthalene-4-sulphonic acid
484 (397)	Direct Blue R	*o*-tolidine: 8-amino-1.7-dihydroxy-6-carboxynaphth aene-3-sulphonic acid
490 (401)	Diamine Blue 3R	3-ethoxybenzidine
491	Diamine Blue B	3-ethoxybenzidine: 1-amino-2-naphthol-3.7-disulphonic acid
494	Oxamine Black BR	Dianisidine: 1.2.4-triaminobenzene (mono oxamic acid)
498 (407)	Azo Violet	dianisidine: 1.2-diaminonaphthalene-4-sulphonic acid
502 (410)	Direct Azurine G (TC)	dianisidine
504 (412)	Congo Blue 2B	dianisidine: 1-amino-2-naphthol-3.6-disulphonic acid
515 (421)	Niagara Blue R	dianisidine: 1.6-diamino-8-naphthol-6-sulphonic acid
522 (427)	Indazurine GM	dianisidine: 8-amino-1.7-dihydroxy-2-carboxynaphthalene-4-sulphonic acid

	Dye	Other reduction products
2-Amino-1-naphthol-4-sulphonic Acid—*Continued.*		
523 (428)	Direct Blue B	dianisidine: 8-amino-1.7-dihydroxy-6-carboxynaphthalene-3-sulphonc acid
548	Oxamine Violet RR	benzidine: 1.2.4-triaminobenzene (mono-oxamic acid)
557 (447)	Benzo Grey S	benzidine: 1.4-diaminonaphthalene: 5-amino-2-hydroxybenzoic acid
564	Oxamine Violet BBR	*o*-tolidine: 1.2.4-triaminobenzene (mono-oxamic acid): 1-amino-2-naphthol
566 (450)	Benzo Black Blue R	*o*-tolidine: 1.4-diaminonaphthalene
571	Oxamine Blue BB	dianisidine: 1-amino-2-naphthol: 1.2.4-triaminobenzene
578 (459)	Benzo Black Blue G	benzidine-3.3-disulphonic acid: 1.4-diaminonaphthalene
604 (483)	St. Danis Direct Red	2.4-diaminotoluene
605 (484)	Milling Scarlet B	2.4-diaminotoluene. 1-amino-2-naphthol-3.6-disulphonic acid
2-Amino-1-naphthol-5-sulphonic Acid		
25	Cochineal Scarlet G	Aniline
62	Cochineal Scarlet 2R	o-toluidine
75 (78)	Cochineal Scarlet 4R	xylidines (mxt.)
84 (108)	Double Ponceau R	1-naphthylamine
180 (164)	Chromotrope F4B	1-naphthylamine-4-sulphonic acid
299 (275)	Chrome Black F (TC)	1.4-diaminonaphthalene: 5-amino-2-hydroxybenzoic acid
355	Milling Scarlet B	4.4′-diamino-2.2′-dimethyl diphenylmethane
503 (411)	Benzo Azurine 3G	dianisidine
2.3-Amino-naphthol-6-sulphonic Acid		
206 (185)	Anthracene Chrome Black F.	1-alkylamino-7-amino-8-naphthol-3.6-disulphonic acid
2.5-Aminonaphthol-7-sulphonic Acid (J-Acid)		
325	Diamine Fast Violet	2.5-diamino-4-methoxytoluene: 2-phenylamino-6-amino-5-naphthol-7-sulphonic acid
4-Amino-1-naphthol-6-sulphonic Acid		
304	Fast Acid Black N2B (TC)	1.4-diaminonaphthalene: 4-aminodiphenylamine-2-sulphonic acid
1-Amino-2-naphthol-3.6.8-trisulphonic Acid		
186 (170)	Ponceau 6R	1-naphthylamine-4-sulphonic acid
199	Heliopurpurine GL	2-naphthylamine-3.6-disulphonic acid
254 (228)	Ponceau 5R	aniline: 1.4-diaminobenzene
2-Amino-1-naphthol-3.6.8-trisulphonic Acid		
387 (322)	Direct Violet B (TC)	benzidine: 1-amino-2-naphthol
464 (378)	Direct Blue R (TC)	*o*-tolidine: 1-amino-2-naphthol
501 (409)	Trisulphone Blue B	dianisidine: 1-amino-2-naphthol
4-Amino-3-oxydiphenylamine		
467 (381)	Azo Black Blue B	*o*-tolidine: 1.7-diamino-8-naphthol-3.6-disulphonic acid
4-Amino-1-phenylnaphthylamine-8-sulphonic Acid		
208 (188)	Fast Acid Blue R (TC)	1.8-aminonaphthol-3.6-disulphonic acid
4-Amino-1-tolylnaphthylamine-8-sulphonic Acid		
209 (189)	Sulphon Acid Blue B	1.8-aminonaphthol-3.6-disulphonic acid
4-Aminophenol		
95 (84)	Azo Chromine	4-amino-1.2.3-trioxybenzene
134 (125)	Diazine Black	Safranine
350	Heligoland Yellow	4-aminophenol
364 (303)	Paper Yellow (TC)	4.4-diamino-2.2-disulpho stilbene
377a	Polar Orange	benzidine: 1.2-diaminonaphthalene-3.6-disulphonic acid: 4-toluene sulphonic acid
379	Oxamine Orange G	benzidine: 2.4.5-triaminotoluene (mono-oxamic acid)
430	Polar Red G	benzidine: 1-amino-2-naphthol-6.8-disulphonic acid: toluene-4-sulphonic acid
430	Polar Red B	*o*-tolidine: 1-amino-2-naphthol-6.8-disulphonic acid: toluene-4-sulphonic acid

	Dye	Other reduction products
4-Aminophenol—*Continued.*		
459 (373)	Polar Orange R	*o*-tolidine: 1.2-diaminonaphthalene-3.6-disulphonic acid: toluene-4-sulphonic acid
583 (464)	Direct Green ET (TC)	benzidine- aniline: 1.2.7-triamino-8-naphthol-3.6-disulphonic acid
586 (467)	Diphenyl Green G	benzidine: 1.4-diamino-2-chlorbenzene: 1.2.7-triamino-8-naphthol-3.6-disulphonic acid
589 (470)	Chloramine Green B (TC)	2.5-dichloraniline: 1.2.7-triamino-8-naphthol-3.6-disulphonic acid
593 (474)	Direct Green B (TC)	benzidine: 1.4-diaminobenzene: 1.2.7-triamino-8-naphthol-3.6-disulphonic acid
642	Polar Yellow 5G	4-amino-1-(4-chloro-2-sulpho benzene)-3-methyl-5-pyrazolone: toluene-4-sulphonic acid
4-Aminophenol-2-sulphonic Acid		
408	Wool Red G	benzidine: 1.2-diamino-8-naphthol-6-sulphonic aicd
4-Aminophenol-2.6-disulphonic Acid		
171 (158)	Chrome Brown RR	4-amino-1.2.3-trihydroxybenzene
2-Aminophenol-4-sulphonic Acid		
167 (154)	Acid Chrome Brown B (TC)	1.2.4-triaminobenzene
168 (155)	Acid Chrome Garnet R (TC)	1-amino-2.4-dihydroxybenzene
169 (156)	Chrome Violet B (TC)	1-amino-2-naphthol
170 (157)	Chrome Black PV (TC)	2-amino-1.5-dihydroxynaphthalene
4-Amino-1-phenyl-3-methyl-5-pyrazolone		
638 (21)	Pigment Chrome Yellow L	2-toluidine
641 (24)	Pigment Fast Yellow R	2-toluidine-5-sulphonic acid
649 (26)	Dianil Yellow R	primuline-sulphonic acid
651 (28)	Pigment Fast Yellow G	2-amino-4-sulpho benzoic acid
652 (29)	Eriochrome Red B	1-amino-2-naphthol-4-sulphonic acid
4-Amino-1-phenylnaphthylamine		
296 (263)	Jet Black R	1.4-diaminonaphthalene: aniline-2.4-disulphonic acid
439 (361)	Sulphone Azurine D	benzidine-3.3-disulphonic acid
3-Aminophenyl-trimethylammonium Chloride		
51 (60)	Azo Phosphine GO	1-amino-2.4-dihydroxybenzene
236	Janus Yellow G	2.4-diamino-1.3-dihydroxybenzene
266 (240)	Janus Red B	2.5-diaminotoluene: 1-amino-2-naphthol
535 (435)	Janus Brown B	1.4-diaminonaphthalene: 1.2.4.5-tetraminobenzene: aniline
2-Amino-4-sulphobenzoic Acid		
651	Pigment Fast Yellow G	4-amino-1-phenyl-3-methyl-5-pyrazolone
4-Amino-1-phenylnaphthylamine-8-sulphonic Acid		
96 (85)	Omega Chrome Black	3.5-diamino-4-cresol
288 (256)	Sulphone Cyanine G	aniline: 1.4-diaminonaphthalene-6 or 7-sulphonic acid
307 (265)	Fast Cyanine Black B (TC)	1.4-diaminonaphthalene: 1-naphthylamine-5-sulphonic acid
4-Amino-1-(4-sulphobenzene)-3-methyl-5-pyrazolone		
636 (19)	Fast Light Yellow 2G (TC)	aniline
650 (27)	Dianil Yellow 2R	primuline-sulphonic acid
4-Amino-1-(4-sulphobenzene)-5-pyrazolone-3-carboxylic Acid		
637 (20)	Kiton Yellow S	aniline
640 (23)	Tartarzine (TC)	1-aminobenzene-4-sulphonic acid
644	Normal Yellow 3GL	*m*-4-xylidine-5-sulphonic acid
646	Dianil Orange G	primuline-sulphonic acid
653	Pyrazol Orange G	benzidine: 5-amino-2-hydroxybenzoic acid
4-Amino-6-sulpho-3-hydroxy-(3-aminophenyl)-1.2-naphthiminazole		
323	Diamine Azo Orange 2R	1-aminobenzene-4-sulphonic acid
6-Amino-7-sulpho-5-hydroxy-(3-aminophenyl)-1.2-naphthiminazole		
321	Diamine Fast Scarlet	aniline: 1-amino-2-naphthol-6-sulphonic acid
322	Diamine Azo Scarlet	1-aminobenzene-4-sulphonic acid

	Dye	Other reduction products
2-Amino-8-toluene-p-sulphonamino-1-naphthol-3.6-disulphonic Acid		
32 (182)	Fast Sulphon Violet 4BS	
1-Amino-2-p-tolylnaphthylamine		
279	Wool Black	1.4-diaminobenzene-2-sulphonic acid: 1-aminobenzene-4-sulphonic acid
4-Amino-1-p-tolylnaphthylamine-8-sulphonic Acid		
289 (257)	Fast Cyanine 5R (TC)	3-aminobenzene-1-sulphonic acid: 1.4-diaminonaphthalene
4-Amino-1.2.3-trihydroxy-benzene		
58 (62)	Azo Galleine	4-amino-dimethylaniline
95 (84)	Azo Chromine	4-amino-1-phenol
171 (158)	Chrome Brown RR	4-aminophenol-2.6-disulphonic acid
Aniline		
15 (31)	Spirit Yellow G (TC)	
19 (32)	Butter Yellow (TC)	4-amino-dimethylaniline
20 (33)	Chrysoidine Y (TC)	1.2.4-triaminobenzene
21 (34)	Chrysoidine R (TC)	2.4.5-triamino-toluene
22	Oil Yellow AB (TC)	1.2-diaminonaphthalene
23 (35)	Sudan G	1-amino-2.4-dihydroxybenzene
24 (36)	Sudan I (TC)	1-amino-2-naphthol
25	Cochineal Scarlet G	2-amino-1-naphthol-5-sulphonic acid
26 (37)	Croceine Orange (TC)	1-amino-2-naphthol-6-sulphonic acid
27 (38)	Orange G (TC)	1-amino-2-naphthol-6.8-disulphonic acid
28 (39)	Acid Orange R	1-amino-2-naphthol-3.6-disulphonic acid
29 (40)	Chromotrope 2R (TC)	2-amino-1.8-dihydroxy naphthalene-3.6-disulphonic acid
30 (41)	Fast Acid Fuchsin B (TC)	1.7-diamino-8-naphthol-3.6-disulphonic acid
31 (42)	Amido Naphthol Red G (TC)	1.7-diamino-8-naphthol-3.6-disulphonic acid; acetic acid
32 (182)	Fast Sulphon Violet 4BS	8-toluene-*p*-sulphon-amino-2-amino-1-naphthol-3.6-disulphonic acid
33 (43)	Tolane Red B, G	1.7-diamino-1-naphthol-4.6-disulphonic acid
34 (44)	Azo Orseille R	2.7-diamino-8-naphthol-3.6-disulphonic acid
35 (45)	Brilliant Lake Red R	1.2-aminonaphthol-3-carboxylic acid
232	Acid Brown R	1.2.4.5-tetraminobenzene: 1-naphthylamine-4-sulphonic acid
243 (216)	Domingo Blue Black B	1.4-diaminobenzene: 1.2.7-triamino-8-naphthol-3.5-disulphonic acid
244 (215)	Blue Black N	1.4-diaminobenzene: 1.2.7-triamino-8-naphthol-4.6-disulphonic acid
245 (219)	Chrome Patent Green C	1.3.5-triamino-2-phenol: 1.2.7-triamino-8-naphthol-4.6-disulphonic acid
246 (217)	Acid Black 10B (TC)	1.4-diaminobenzene: 1.2.7-triamino-8-naphthol-3.6-disulphonic acid
247	Azo Dark Green A	
248 (223)	Oil Scarlet LB	1-amino-2-naphthol: 1.4-diaminobenzene
249 (224)	Cloth Red G	2-amino-1-naphthol-4-sulphonic acid: 1.4-diaminobenzene
250 (225)	Croceine AZ	2-amino-1-naphthol-3.6-disulphonic acid: 1.4-diaminobenzene
251 (226)	Croceine B	2-amino-1-naphthol-4.8-disulphonic acid: 1.4-diaminobenzene
252 (227)	Brilliant Croceine (TC)	1-amino-2-naphthol-6.8-disulphonic acid: 1.4-diaminobenzene
253	Ponceau SS (TC)	1-amino-2-naphthol-3.6-disulphonic acid
254 (228)	Ponceau 5R	1-amino-2-naphthol-3.6.8-trisulphonic acid
255 (229)	Azo Acid Violet BX	7-amino-1.8-dihydroxynaphthalene-4-sulphonic acid
267 (241)	Neutral Gray G	1.4-diaminonaphthalene: 2.7-diamino-8-naphthol-6-sulphonic acid
271 (242)	Sulphone Black G	1.4-diaminonaphthalene-6 or 7-sulphonic acid: 7-amino-1.8-dihydroxynaphthalene-4-sulphonic acid
288 (256)	Sulphone Cyanine G	1.4-diaminonaphthalene-6 or 7-sulphonic acid: 4-amino-1-phenylnaphthylamine-8-sulphonic acid

	Dye	Other reduction products
Aniline—*Continued.*		
321	Diamine Fast Scarlet	6-amino-7-sulpho-5-hydroxy-(3-aminophenyl)-1.2-naphthiminazole: 1-amino-2-naphthol-6-sulphonic acid
324	Diazo Brilliant Scarlet	3-aminobenzoyl-3-aminobenzoyl-2-amino-5-naphthol-6-amino-7-sulphonic acid
324a	Rosanthrene O	6-amino-2-amino (3-aminobenzoyl)-5-naphthol-7-sulphonic acid
326 (279)	Direct Fast Scarlet (TC)	J-acid urea: 1.4-diaminobenzene
531	Chrome Patent Green A	1.2.7-triamino-8-naphthol-4.6-disulphonic acid: 1.4-diaminonaphthalene: 5-amino-2-hydroxybenzoic acid
533	Diphenyl Fast Blue B	1.4-diaminonaphthalene-6-sulphonic acid: 2.6-diamino-5-naphthol-7-sulphonic acid
535 (435)	Janus Brown B	1.4-diaminonaphthalene: 3-aminophenyl trimethylammonium chloride: 1.2.4.5-tetraminobenzene
536 (435)	Janus Brown R	1.4-diaminonaphthalene: 4-amino-benzyl diethylamine: 1.2.4.5-tetraminobenzene
581 (462)	Direct Black EW (TC)	Benzidine: 1.2.4-triaminobenzene: 1.2.7-triamino-8-naphthol-3.6-disulphonic acid
582 (463)	Direct Black RW (TC)	Benzidine: 2.4.5-triaminotoluene: 1.2.7-triamino-8-naphthol-3.6-disulphonic acid
583 (464)	Direct Green ET (TC)	Benzidine: 4-aminophenol: 1.2.7-triamino-8-naphthol-3.6-disulphonic acid
624 (12)	Diphenyl Citronine G	4.4-diamino-2.2-disulpho-stilbene
636 (19)	Fast Light Yellow 2G (TC)	4-amino-1-(4-sulphobenzene)-3-methyl-5-pyrazolone
637 (20)	Kiton Yellow S	4-amino-1-(4-sulphobenzene)-5-pyrazolone-3-carboxylic acid
Aniline-2.4-disulphonic Acid		
296 (263)	Jet Black R	1.4-diaminonaphthalene: 4-amino-1-phenylnaphthylamine
2-Anisidine		
112 (96)	Chrome Fast Yellow 2G	5-amino-2-hydroxybenzoic acid
113 (93)	Sudan R	1-amino-2-naphthol
114 (94)	Azo Eosine G	2-amino-1-naphthol-4-sulphonic acid
115 (95)	Azo Cochineal	2-amino-1-naphthol-4.8-disulphonic acid
Benzidine		
109 (103)	Mordant Yellow GRO	5-amino-2-hydroxybenzoic acid
367	Congo GR	1-aminobenzene-3-sulphonic acid: 1.2-diaminonaphthalene-4-sulphonic acid
368 (306)	Pyramine Orange 3G	1.2.4.5-tetraminobenzene: 1.2.3-triaminobenzene-4.6-disulphonic acid
369 (314)	Pyramine Orange 2R	1.2.4.5-tetraminobenzene: 1.2-diaminonaphthalene-3.6-disulphonic acid
370 (307)	Congo Red (TC)	2-amino-1-naphthol-4-sulphonic acid
371 (308)	Diazo Black B	1.2-diaminonaphthalene-5-sulphonic acid
372 (310)	Glycine Corinth	1.4-diaminonaphthalene-mono-glycine
373 (309)	Glycine Red	1.4-diaminonaphthalene-mono-glycine: 1.2-diaminonaphthalene-4-sulphonic acid
374 (311)	Orange TA	1.2-diaminonaphthalene-4-sulphonic acid: amino-cresol
375 (312)	Congo Corinth G (TC)	1.2-diaminonaphthalene-4-sulphonic acid: 2-amino-1-naphthol-4-sulphonic acid
376 (313)	Congo Rubine	1.2-diaminonaphthalene-4-sulphonic acid: 1-amino-2-naphthol-8-sulphonic acid
377 (315)	Congo Orange G	1.2-diaminonaphthalene-3.6-disulphonic acid: 4-phenetidine
377a	Polar Orange	1.2-diaminonaphthalene-3.6-disulphonic acid: 4-aminophenol: 4-toluene sulphonic acid
378 (316)	Brilliant Congo G	1.2-diaminonaphthalene-3.6-disulphonic acid: 1.2-diaminonaphthalene-6-sulphonic acid
379	Oxamine Orange G	4-aminophenol: 2.4.5-triaminotoluene (mono oxamic acid)
380 (317)	Pyramidol Brown BG	1-amino-2.4-dihydroxybenzene

	Dye	Other reduction products
Benzidine—*Continued.*		
381 (318)	Benzidine Puce	1-amino-2-naphthol
382 (319)	Diamine Scarlet B	4-phenetidine: 1-amino-2-naphthol-6.8-disulphonic acid
383	Oxamine Scarlet B	1.2-diaminonaphthalene-4-sulphonic acid: 1.2.4-triaminobenzene (mono-oxamic acid)
384	Oxamine Red B	2-amino-1-naphthol-4-sulphonic acid 1.2.4-triaminobenzene (mono-oxamic acid)
385 (320)	Bordeaux (TC)	1-amino-2-naphthol-8-sulphonic acid
386 (321)	Heliotrope 2B	1-amino-2-naphthol-8-sulphonic acid: 2-amino-1-naphthol-4.8-disulphonic acid
387 (322)	Direct Violet B (TC)	1-amino-2-naphthol: 2-amino-1-naphthol-3.6.8-trisulphonic acid
388	Benzo Violet R	2-amino-1-naphthol-4-sulphonic acid: 2-amino-1-naphthol-3.6-disulphonic acid
389	Dianil Blue 4R	1-amino-2-naphthol-6-sulphonic acid: 2-amino-1.8-dihydroxynaphthalene-3.6-disulphonic acid
390 (323)	Dianil Blue R	2-amino-1.8-dihydroxy naphthalene-3.6-disulphonic acid
391 (324)	Chicago Blue 4R	1-amino-2-naphthol-8-sulphonic acid: 1.7-diamino-8-naphthol-4-sulphonic acid
392 (325)	Columbia Blue R	2-amino-1-naphthol-3.8-disulphonic acid; 1.7-diamino-8-naphthol-4-sulphonic acid
393 (326)	Oxamine Violet	2.6-diamino-5-naphthol-7-sulphonic acid
394 (327)	Direct Violet N. (TC)	1.2-diamino-8-naphthol-6-sulphonic acid
395 (328)	Diamine Black RO	1.2-diamino-8-naphthol-6-sulphonic acid: 2.7-diamino-8-naphthol-6-sulphonic acid
396 (329)	Diamine Brown V	2.7-diamino-8-naphthol-6-sulphonic acid: 1.2.4-triaminobenzene
397	Azo Mauve R	1.4-diamino-naphthalene: 1.7-diamino-8-naphthol-3.6-disulphonic acid
398 (330)	Zambesi Brown G	1.2.7-triaminonaphthalene-3.6-disulphonic acid: 2.7-diamino-8-naphthol-6-sulphonic acid
400 (332)	Benzo Fast Red 9BL	1.2-diaminonaphthalene-3.6-disulphonic acid: 1.2-diamino-8-naphthol-6-sulphonic acid
401 (333)	Developed Black BHN (TC)	1.7-diamino-8-naphthol-3.6-disulphonic acid: 2.7-diamino-8-naphthol-6-sulphonic acid
402 (334)	Diphenyl Blue Black	1.7-diamino-8-naphthol-3.6-disulphonic acid: 2-ethylamino-7-amino-8-naphthol-6-sulphonic acid
404 (335)	Naphthamine Black RE	2.7-diamino-8-naphthol-6-sulphonic acid: 1.7-diamino-8-naphthol-4.6-disulphonic acid
405 (336)	Benzo Cyanine R	1.7-diamino-8-naphthol-4-sulphonic acid: 1.7-diamino-8-naphthol-3.6-disulphonic acid
406 (337)	Direct Blue 2B (TC)	1.7-diamino-8-naphthol-3.6-disulphonic acid
407 (338)	Naphthamine Blue 2B	1.7-diamino-8-naphthol-4.6-disulphonic acid
408	Wool Red G	1.2-diamino-8-naphthol-6-sulphonic acid: 4-aminophenol-2-sulphonic acid
409 (339)	Brilliant Orange G	5-amino-2-hydroxybenzoic acid: 2.5-diaminophenol-4-sulphonic acid
410 (342)	Chrysamine G (TC)	5-amino-2-hydroxybenzoic acid
411 (351)	Cresotine Yellow G (TC)	5-amino-2-cresol-3-carboxylic acid
412	Cloth Orange	5-amino-2-hydroxybenzoic acid: 1-amino-2.4-dihydroxybenzene
413	Cloth Brown R	5-amino-2-hydroxybenzoic acid: 2-amino-1-naphthol-4-sulphonic acid
414	Cloth Brown G	5-amino-2-hydroxybenzoic acid: 1-amino-2.7-dihydroxynaphthalene
415 (340)	Direct Orange R (TC)	5-amino-2-hydroxybenzoic acid: 1.2-diaminonaphthalene-4-sulphonic acid
416	Chlorazol Orange 2R	5-amino-2-hydroxybenzoic acid: 1.2-diaminonaphthalene-7-sulphonic acid
417 (341)	Crumpsall Direct Fast Red R	5-amino-2-hydroxybenzoic acid: 1-amino-2-naphthol-3.6-disulphonic acid
418	Diamine Nitrazol G	5-amino-2-hydroxybenzoic acid: 1.7-diamino-8-naphthol-4.6-disulphonic acid
419 (343)	Direct Fast Red F (TC)	5-amino-2-hydroxybenzoic acid: 1.2-diamino-8-naphthol-6-sulphonic acid

	Dye	Other reduction products
Benzidine—*Continued.*		
420 (344)	Direct Brown M (TC).......	5-amino-2-hydroxybenzoic acid: 2.7-diamino-8-naphthol-6-sulphonic acid
421 (347)	Diphenyl Brown RN........	5-amino-2-hydroxybenzoic acid: 2-methylamino-7-amino-8-naphthol-6-sulphonic acid
422 (348)	Diphenyl Brown BN.........	5-amino-2-hydroxybenzoic acid: 2-(dimethyl) amino-7-amino-8-naphthol-6-sulphonic acid
423 (349)	Chlorazol Brown B..........	5-amino-2-hydroxybenzoic acid: 2-phenylamino-7-amino-8-naphthol-6-sulphonic acid
424 (345)	Oxamine Maroon............	5-amino-2-hydroxybenzoic acid: 1.6-diamino-5-naphthol-7-sulphonic acid
425 (346)	Oxamine Red..............	5-amino-2-hydroxybenzoic acid: 2.6-diamino-5-naphthol-7-sulphonic acid
426 (350)	Alkali Yellow R.............	5-amino-2-hydroxybenzoic acid: dehydrothio-*p*-toluidine sulphonic acid
428 (352)	Direct Violet R	
430	Polar Red G............ ...	1-amino-2-naphthol-6.8-disulphonic acid: 4-aminophenol: toluene-4-sulphonic acid
546	Oxamine Violet GRF........	1-amino-2-naphthol-3.6-disulphonic acid: 1.2.4-triaminobenzene (mono-oxamic acid)
547	Oxamine Black MB.........	2.7-diamino-8-naphthol-6-sulphonic acid: 1.2.4-triaminobenzene (mono-oxamic acid)
548	Oxamine Violet RR..........	2-amino-1-naphthol-4-sulphonic acid: 1.2.4-triaminobenzene (mono-oxamic acid)
549 (438)	Diamine Beta Black B.......	1.7-diamino-8-naphthol-3.6-disulphonic acid: 2.5-diamino-1.4-dimethylbenzene
550 (439)	Direct Indigo Blue A........	1.7-diamino-8-naphthol-3.6-disulphonic acid: 2.5-diamino-4-methoxytoluene
551 (440)	Direct Indigo Blue BK.......	2.7-diamino-8-naphthol-6-sulphonic acid: 2.5-diamino-4-methoxytoluene
552 (441)	Diazo Blue Black RS........	1.7-diamino-8-naphthol-3.6-disulphonic acid: 1.4-diaminonaphthalene
553 (442)	Direct Black V.............	2.7-diamino-8-naphthol-3.6-disulphonic acid: 1.4-diaminonaphthalene: 2.7-diamino-8-naphthol-6-sulphonic acid
554 (443)	Direct Indone Blue R........	1.4-diaminonaphthalene: 2.7-diamino-8-naphthol-3.6-disulphonic acid: 1.7-diamino-8-naphthol-3.6-disulphonic acid
555 (444)	Crumpsall Direct Fast Brown B.......................	2.5-diamino-1.4-dimethylbenzene: 5-amino-2-hydroxybenzoic acid: 2.7-diamino-8-naphthol-6-sulphonic acid
556 (445)	Crumpsall Direct Fast Brown O.......................	2.5-diamino-1.4-dimethylbenzene: 5-amino-2-hydroxybenzoic acid: 2-phenylamino-7-amino-8-naphthol-6-sulphonic acid
557 (447)	Benzo Grey S...............	1.4-diaminonaphthalene: 5-amino-2-hydroxybenzoic acid: 2-amino-1-naphthol-4-sulphonic acid
558 (446)	Benzo Olive...............	1.4-diaminonaphthalene: 5-amino-2-hydroxybenzoic acid: 1.7-diamino-8-naphthol-3.6-disulphonic acid
559 (448)	Diamine Bronze G..........	5-amino-2-hydroxybenzoic acid: 1.7-diamino-8-naphthol-3.6-disulphonic acid: 1.2.4-triaminobenzene
560	Cotton Dark Brown T.......	5-amino-2-hydroxybenzoic acid: 1.2.4-triaminobenzene: 2.7-diamino-8-naphthol-6-sulphonic acid
561 (449)	Chlorazol Brown LF.........	1-naphthylamine-4-sulphonic acid: 2.7-diamino-8-naphthol-3.6-disulphonic acid: 2.3.4.5-tetraminotoluene: 5.-amino-2-hydroxybenzoic acid
581 (462)	Direct Black EW (TC)......	Aniline: 1.2.4-triaminobenzene: 1.2.7-triamino-8-naphthol-3.6-disulphonic acid
582 (463)	Direct Black RX (TC).......	aniline: 2.4.5-triaminotoluene: 1.2.7-triamino-8-naphthol-3.6-disulphonic acid

	Dye	Other reduction products
Benzidine—*Continued.*		
583 (464)	Direct Green ET (TC).......	aniline: 4-aminophenol: 1.2.7-triamino-8-naphthol-3.6-disulphonic acid
585 (466)	Eboli Green CW............	1-aminobenzene-4-sulphonic acid: 1.2.7-triamino-8-naphthol-3.6-disulphonic acid: 5-amino-2-hydroxybenzoic acid
586 (467)	Diphenyl Green G...........	1.4-diamino-2-chlorbenzene: 4-aminophenol: 1.2.7-triamino-8-naphthol-3.6-disulphonic acid
587 (468)	Diphenyl Green 3G..........	1.4-diamino-2-chlorbenzene: 5-amino-2-hydroxybenozic acid: 1.2.7-triamino-8-naphthol-3.6-disulphonic acid
588 (469)	Chloramine Black N.........	2.5-dichloro-aniline: 1.2.7-triamino-8-naphthol-3.6-disulphonic acid: 1.2.4-triaminobenzene
589 (470)	Chloramine Green B (TC)....	2.5-dichloro-aniline: 1.2.7-triamino-8-naphthol-3.6-disulphonic acid: 4-amino-1-phenol
590 (471)	Chloramine Blue 3G.........	2.5-dichloro-aniline: 1.7-diamino-8-naphthol-3.6-disulphonic acid: 1.2.7-triamino-8-naphthol-3.6-disulphonic acid
591 (472)	Chloramine Blue HW........	2.5-dichloro-aniline: 1.2.7-triamino-8-naphthol-3.6-disulphonic acid: 2.7-diamino-8-naphthol-6-sulphonic acid
592 (473)	Naphthamine Black H.......	1.4-diaminobenzene: 1.2.7-triamino-8-naphthol-3.6-disulphonic acid
593 (474)	Direct Green B (TC)........	1.4-diaminobenzene: 1.2.7-triamino-8-naphthol-3.6-disulphonic acid: 4-amino-phenol
594 (475)	Direct Green G (TC)........	1.4-diaminobenzene: 1.2.7-triamino-8-naphthol-3.6-disulphonic acid: 5-amino-2-hydroxybenzoic acid
595	Diazo Olive G..............	1.4-diaminobenzene: 1.2.7-triamino-8-naphthol-4-sulphonic acid: 5-amino-2-hydroxybenzoic acid
596 (476)	Direct Brown 3GO (TC).....	1-aminobenzene-4-sulphonic acid: 1.2.4.5-tetraminobenzene: 5-amino-2-hydroxybenzoic acid
597	Dianil Chrome Brown R.....	1-naphthylamine-4-sulphonic acid: 1.2.4.5-tetraminobenzene: 5-amino-2-hydroxybenzoic acid
598 (477)	Congo Brown G (TC)........	1-aminobenzene-4-sulphonic acid: 2.4-diamino-1.3-dihydroxybenzene: 5-amino-2-hydroxybenzoic acid
599 (578)	Direct Green CO............	1-aminobenzene-4-sulphonic acid: 1.2.7-triamino-8-naphthol-4-sulphonic acid: 5-amino-2-hydroxybenzoic acid
600 (479)	Dianil Black R..............	1-naphthylamine-4-sulphonic acid: 2.7-diamino-1.8-dihydroxynaphthalene-3.6-disulphonic acid: 1.2.4-triaminobenzene
601 (480)	Congo Brown R.............	1-naphthylamine-5-sulphonic acid: 2.4-diamino-1.3-dihydroxybenzene: 5-amino-2-hydroxybenzoic acid
610 (489)	Hessian Brown BBN........	1-aminobenzene-4-sulphonic acid: 2.4-diamino-1.3-dihydroxybenzene
612 (490)	Cotton Brown A............	1.2.4.5-tetraminobenzene: 1-naphthylamine-4-sulphonic acid
633 (15)	Chicago Orange R...........	4.4-diamino-2.2-disulpho-stilbene
653	Pyrazole Orange G..........	5-amino-2-hydroxybenzoic acid: 4-amino-1-(4-sulphobenzene)-5-pyrazolone-3-carboxylic acid
Benzidine-2.2-disulphonic Acid		
441	Chromazol Yellow CR.......	5-amino-2-hydroxybenzoic acid

	Dye	Other reduction products
Benzidine-2.2-disulphonic Acid—*Continued.*		
442	Chromo Citronine RR.......	5-amino-2-cresol-3-carboxylic acid
443	Acid Anthracene Red G......	1-amino-2-naphthol
Benzidine-3.3-disulphonic Acid		
439 (361)	Sulphone Azurine D.........	4-amino-1-phenylnaphthylamine
440 (360)	Pyramine Orange R.........	1.2.4.5-tetraminobenzene
578 (459)	Benzo Black Blue G.........	1.4-diaminonaphthalene: 2-amino-1-naphthol-4-sulphonic acid
579 (460)	Benzo Black Blue 5G........	1.4-diaminonaphthalene: 7-amino-1.8-dihydroxynaphthalene-4-sulphonic acid
617 (491)	Dianil Black PR............	2.7-diamino-8-naphthol-6-sulphonic acid: 1.2.4-triaminobenzene
Benzidine-3-sulphonic Acid		
438 (359)	Trypan Red................	1.2-diaminonaphthalene-3.6-disulphonic acid
2-Benzoylamino-6-amino-5-naphthol-7-sulphonic Acid		
278	Benzo Fast Red 8 BL........	1.4-diaminobenzene: 1-aminobenzene-4-sulphonic acid
4-Chlor-2-amino-anisole		
116 (97)	Chloranisidine Salt M........	
116 (97)	Chloranisidine Scarlet........	1-amino-2-naphthol
3-Chloraniline-6-sulphonic Acid		
156 (131)	Permanent Orange R........	1-amino-2-naphthol
4-Chloraniline-2-sulphonic Acid		
292 (260)	Eriochrome Verdone S.......	2.5-diamino-4-cresol: 1-amino-2-naphthol
2-Chlor-5-toluidine-4-sulphonic Acid		
165 (153)	Lake Red C (TC)...........	1-amino-2-naphthol
166	Lithol Red 2G..............	1.2-aminonaphthol-3-carboxylic acid
3-Chloro-2-toluidine-5-sulphonic Acid		
643 (30)	Radial Yellow G............	4-amino-1-(2-chloro-4-sulpho-6-methylbenzene)-3-methyl-5-pyrazolone
3-Chlor-1.2.4-triaminobenzene-6-sulphonic Acid		
149	New Fast Yellow R.........	1-aminobenzene-4-sulphonic acid
Cumidine (Crude)		
80 (83)	Ponceau 3R................	1-amino-2-naphthol-3.6-disulphonic acid
1.2.4.5-Cumidine (Pseudo-cumidine)		
80 (83)	Ponceau 4R................	1-amino-2-naphthol-3.6-disulphonic acid
Dehydrothio-*p*-toluidine		
126 (117)	Erika 2GN.................	2-amino-1-naphthol-3.8-disulphonic acid
127 (118)	Geranine 2B...............	2-amino-1-naphthol-3-sulphonic acid
128 (119)	Diamine Pink R............	2-amino-1-naphthol-8-chlor-3.6-disulphonic acid
Dehydro-thio-*p*-toluidine-sulphonic Acid		
43 (51)	Thiazol Yellow R...........	1.4-diaminobenzene
223 (199)	Cotton Yellow R............	5-amino-2-hydroxybenzoic acid
224 (193)	Clayton Cloth Red..........	1-amino-2-naphthol
225 (194)	Direct Pink R (TC).........	2-amino-1-naphthol-4-sulphonic acid
226 (196)	Clayton Cloth Scarlet........	1-amino-2-naphthol-6-sulphonic acid
426 (350)	Alkali Yellow R.............	Benzidine: 5-amino-2-hydroxybenzoic acid
632 (18)	Diphenyl Fast Yellow........	4.4-diamino-2.2-disulpho-stilbene
634 (16)	Curcuphenine..............	4.4-diamino-2.2-disulpho-stilbene: 4-toluidine-2-sulphonic acid
Dehydrothio-*m*-xylidine		
129 (120)	Salmon Red................	1.2-diaminonaphthalene-3.6-disulphonic acid
130 (121)	Erika B Ex................	2-amino-1-naphthol-3.8-disulphonic acid
131 (122)	Erika G. Ex................	1-amino-2-naphthol-6.8-disulphonic acid
2.4-Diamino-anisole		
118 (99)	Fast Scarlet R Base.........	
118 (99)	Tuscaline Orange G.........	1-amino-2-naphthol
2.5-Diamino-anisole		
117 (98)	Fast Red B Base............	
117 (98)	Nitrosamine Pink BX........	1-amino-2-naphthol
291 (259)	Ponceau 10RB.............	1-aminobenzene-4-sulphonic acid: 1-amino-2-naphthol-8-sulphonic acid

	Dye	Other reduction products
1.3-Diaminobenzene (*m*-phenylene-diamine)		
36 (48)	Alizarine Yellow GG........	5-amino-2-oxy-benzoic acid
37 (49)	Prague Alizarine Yellow G...	3-amino-4.6-dioxybenzoic acid
38 (46)	*m*-Nitraniline Orange (on the fibre)..................	1-amino-2-naphthol
39 (47)	Orange III..................	1-amino-2-naphthol-3.6-disulphonic acid
331 (283)	Bismarck Brown (TC).......	1.2.4-triaminobenzene
542	Para Bronze NB...........	1-amino-2.4-dihydroxybenzene: 1.7-diamino-8-naphthol-3.6-disulphonic acid
543	Diamino Fast Bordeaux......	1-amino-2.4-dihydroxybenzene: 2.6-diamino-5-naphthol-7-sulphonic acid
544	Pluto Black 5 BSX..........	4.4-diaminodiphenylamine: 2.7-diamino-8-naphthol-6-sulphonic acid
606 (485)	Direct Brown G (TC).......	1.2.4.5-tetraminobenzene: 1-aminobenzene-4-sulphonic acid
607 (486)	Direct Brown J............	1.2.4.5-tetraminobenzene: 3-amino-1-benzoic acid
608 (487)	Direct Brown B (TC).......	1.2.4.5-tetraminobenzene: 1-naphthylamine-4-sulphonic acid
1.4-Diaminobenzene (*p*-phenylene-diamine)		
15 (31)	Spirit Yellow G (TC).......	aniline
40 (58)	Chrome Yellow R (TC)......	5-amino-2-oxybenzoic acid.
41	Prague Alizarine Yellow R...	3-amino-4.6-dioxybenzoic acid
42 (50)	Azo Cardinal G............	4-amino-1-ethyl benzylaniline-(4-sulphonic acid)
43 (51)	Thiazol Yellow R..........	dehydrothio-*p*-toluidine-sulphonic acid
44 (56)	Para Red..................	1-amino-2-naphthol
45 (57)	Chromotrope 2B...........	2-amino-1.8-dioxynaphthalene-3.6-disulphonic acid
46 (52)	Archil Substitute..........	1.2-diamino-naphthalene-4-sulphonic acid
47 (53)	Archil Substitute 3 VN......	1.2-diamino-naphthalene-5-sulphonic acid
48 (54)	Apollo Red B..............	1.2-diamino-naphthalene-4.7-disulphonic acid
49 (55)	Brilliant Archil C..........	1.7-diamino-8-hydrazine-naphthalene-3.6-disulphonic acid
52	Azo Alizarine Yellow GP.....	5-amino-2-oxy-benzoic acid
53 (61)	Victoria Violet (TC)........	2-amino-1.8-dioxynaphthalene-3.6-disulphonic acid
54 (64)	Kiton Red S...............	2-amino-1-naphthol-3.6-disulphonic acid
55 (65)	Azo Coralline (TC).........	1-amino-2-naphthol-3.6-disulphonic acid
56 (67)	Chromotrope 6B (TC).......	2-amino-1.8-dioxynaphthalene-3.6-disulphonic acid, acetic acid
57 (66)	Amido Naphthol Red 6 B (TC)..................	1.7-diamino-8-naphthol-3.6-disulphonic acid, acetic acid
230 (208)	Leather Brown.............	1.2.4.5-tetraminobenzene
238 (221)	Anthracene Acid Brown R ..	1-aminobenzene-4-sulphonic acid: 3.5-diamino-2-hydroxy benzoic acid
243 (216)	Domingo Blue Black B......	aniline: 1.2.7-triamino-8-naphthol-3.5-disulphonic acid
244 (215)	Blue Black N..............	aniline: 1.2.7-tr amino-8-naphthol 4.6-disulphonic acid
246 (217)	Acid Black 10B (TC).......	aniline: 1.2.7-triamino-8-naphthol-3.6-disulphonic acid
247	Azo Dark Green A..........	aniline: 1.2.7-triamino-8-naphthol-3.6-disulphonic acid
248 (223)	Oil Scarlet LB.............	aniline: 1-amino-2-naphthol
249 (224)	Cloth Red G...............	aniline: 2-amino-1-naphthol-4-sulphonic acid
250 (225)	Croceine AZ...............	aniline: 2-amino-1-naphthol-3.6-disulphonic acid
251 (226)	Croceine B................	aniline: 2-amino-1-naphthol-4.8-disulphonic acid
252 (227)	Brilliant Croceine (TC)......	aniline: 1-amino-2-naphthol-6.8-disulphonic acid
253	Ponceau SS (TC)...........	aniline: 1-amino-2-naphthol-3.6-disulphonic acid
254 (228)	Ponceau 5R...............	aniline: 1-amino-2-naphthol-3.6.8-trisulphonic acid

	Dye	Other reduction products
1.4-Diaminobenzene (*p*-**phenylene-diamine**)—*Continued.*		
255 (229)	Azo Acid Violet BX	aniline: 7-amino-1.8-dihydroxynaphthalene-4-sulphonic acid
265 (239)	Azotol C	1-amino-2-naphthol: 4-amino-1-dimethylaminobenzene
268 (245)	Nyanza Black B	1.4-diaminonaphthalene: 2.7-diamino-8-naphthol-6-sulphonic acid
269 (243)	Coomassie Wool Black R	1.4-diaminonaphthalene: 1-amino-2-naphthol-6-sulphonic acid
270 (244)	Coomassie Wool Black S	1.4-diaminonaphthalene: 1-amino-2-naphthol-3.6-disulphonic acid
273	Benzo Brown D3G	1-aminobenzene-4-sulphonic acid: 1.2.4-triaminobenzene
274 (250)	Milling Orange	1-aminobenzene-4-sulphonic acid: 5-amino-2-hydroxybenzoic acid
275 (246)	Cloth Scarlet G (TC)	1-aminobenzene-4-sulphonic acid: 1-amino-2-naphthol
276 (248)	Fast Scarlet B	1-aminobenzene-4-sulphonic acid: 1-amino-2-naphthol-6-sulphonic acid
277 (249)	Groceine Scarlet 3B	1-aminobenzene-4-sulphonic acid: 1-amino-2-naphthol-8-sulphonic acid
278	Benzo Fast Red 8 BL	1-aminobenzene-4-sulphonic acid: 2-benzoylamino-6-amino-5-naphthol-7-sulphonic acid
297	Ingrain Black C	1.4-diaminonaphthalene-6-sulphonic acid: 2.7-diamino-8-naphthol-6-sulphonic acid
326 (279)	Direct Fast Scarlet (TC)	aniline: J-acid urea
338 (290)	Violet Black	1.4-diaminonaphthalene: 2-amino-1-naphthol-4-sulphonic acid
339	Para Black R	1.2.4-triaminobenzene: 1.7-diamino-8-naphthol-4.6-disulphonic acid
340	Chrome Red S	5-amino-2-hydroxybenzoic acid: 1.2-diaminonaphthalene-6-sulphonic acid
341 (291)	Azo Alizarine Bordeaux W	5-amino-2-hydroxybenzoic acid: 2-amino-1-naphthol-4-sulphonic acid
342 (292)	Azo Alizarine Black I	5-amino-2-hydroxybenzoic acid: 2-amino-1.8-dihydroxynaphthalene-3.6-disulphonic acid
537	Titan Black J	1.4-diaminonaphthalene-6-sulphonic acid: 1.2.4-triaminobenzene: 2.6-diamino-5-naphthol-7-sulphonic acid
539 (436)	Direct Fast Black FF (TC)	1.4-diaminonaphthalene-6-sulphonic acid: 2.7-diamino-8-naphthol-6-sulphonic acid: 1.2.4-triaminobenzene
539 (436)	Direct Fast Black FB (TC)	1.4-diaminonaphthalene-6-sulphonic acid: 2.7-diamino-8-naphthol-6-sulphonic acid: 2.4.5-triaminotoluene
540 (437)	Isodiphenyl Black R	1.2.4-triaminobenzene: 1-amino-2.4-dihydroxybenzene: 2.7-diamino-8-naphthol-6-sulphonic acid
592 (473)	Naphthamine Black H	benzidine: 1.2.7-triamino-8-naphthol-3.6-disulphonic acid
593 (474)	Direct Green B (TC)	benzidine: 1.2.7-triamino-8-naphthol-3.6-disulphonic acid: 4-aminophenol
595	Diazo Olive G	benzidine: 1.2.7-triamino-8-naphthol-4-sulphonic acid: 5-amino-2-hydroxybenzoic acid
619	Naphthamine Fast Black RS	1.2.4-triaminobenzene: 1.2.7-triamino-8-naphthol-3.6-disulphonic acid
625 (13)	Cotton Brown R	4.4-diamino-2.2-disulpho-stilbene:
627 (205)	Diphenyl Chrysoine RR	4.4-diamino-2.2-disulpho-stilbene: 4-phenetidine
628 (206)	Diphenyl Catechine G	4.4-diamino-2.2-disulpho-stilbene: 2-dimethylamino-7-amino-8-naphthol-6-sulphonic acid
1.2-Diaminobenzene-4-sulphonic Acid		
159 (148)	Fast Orange O	1-amino-2-naphthol
1.4-Diaminobenzene-2-sulphonic Acid		
16 (137)	Fast Yellow, Acid Yellow	1-aminobenzene-4-sulphonic acid
157 (133)	Eriochrome Phosphine R	5-amino-2-hydroxybenzoic acid

	Dye	Other reduction products
1.4-Diaminobenzene-2-sulphonic Acid—*Continued.*		
158 (132)	Lake Red P	1-amino-2-naphthol
279	Wool Black	1-aminobenzene-4-sulphonic acid: 1-amino-2-*p*-tolylnaphthylamine
280 (247)	Scarlet EC (TC)	1-aminobenzene-4-sulphonic acid: 1-amino-2-naphthol
281 (251)	Crocein Scarlet OX	1-aminobenzene-4-sulphonic acid: 1-amino-2-naphthol-8-sulphonic acid
282	Ponceau	1-aminobenzene-4-sulphonic acid: 1-amino-2-naphthol-3.6-disulphonic acid
2.7-Diamino Carbazol		
445	Carbazole Yellow	5-amino-2-hydroxybenzoic acid
1.4-Diamino-2-chlorbenzene		
586 (467)	Diphenyl Green G	benzidine: 4-aminophenol: 1.2.7-triamino-8-naphthol-3.6-disulphonic acid
587 (468)	Diphenyl Green 3G	benzidine: 5-amino-2-hydroxybenzoic acid: 1.2.7-triamino-8-naphthol-3.6-disulphonic acid
2.5-Diamino-4-cresol		
292 (260)	Eriochrome Verdone A	1-aminobenzene-4-sulphonic acid: 1-amino-2-naphthol
292 (260)	Eriochrome Verdone S	4-chloraniline-2-sulphonic acid: 1-amino-2-naphthol
3.5-Diamino-2-cresol		
8	Victoria Yellow	3.5-diamino-4-cresol
3.5-Diamino-4-cresol		
8	Victoria Yellow	3.5-diamino-2-cresol
96 (85)	Omega Chrome Black	4-amino-1-phenylnaphthylamine-8-sulphonic acid
1.1′-Diamino-4.4′-dichloro-diphenyl-2.2′-diimino-methane		
13 (8)	Pigment Chlorine GG	
1.1′-Diamino-5.5′-dichloro-phenyl-2.2′-di-imino-methane		
14	Lithol Fast Yellow GG	
2.4-Diamino-1.3-dihydroxy Benzene		
1 (1)	Fast Green O	
234 (211)	Resorcine Brown B (TC)	*m*-xylidine: 1-aminobenzene-4-sulphonic acid
235 (213)	Resorcine Dark Brown (TC)	1-naphthylamine-4-sulphonic acid
236	Janus Yellow G	3-aminophenyl trimethylammonium chloride
598 (477)	Congo Brown G (TC)	benzidine: 1-aminobenzene-4-sulphonic acid: 5-amino-2-hydroxybenzoic acid
601 (480)	Congo Brown R	benzidine: 1-naphthylamine-5-sulphonic acid: 5-amino-2-hydroxybenzoic acid
602 (481)	Azo Corinth	*o*-tolidine: 1-naphthylamine-4-sulphonic acid: 3.4-diaminophenol-6-sulphonic acid
610 (489)	Hessian Brown BBN	benzidine: 1-aminobenzene-4-sulphonic acid:
611	Hessian Brown MM	*o*-tolidine: 1-aminobenzene-4-sulphonic acid
2.7′-Diamino-1.8-dihydroxynaphthalene-3.6-disulphonic Acid		
600 (479)	Dianil Black R	benzidine: 1-naphthylamine-4-sulphonic acid: 1.2.4-triaminobenzene
4.4-Diamino-2.2′-dimethoxy-diphenylurea		
349	Benzo Light Yellow 4GL	3-aminobenzoic acid
2.5-Diamino-1.4-dimethylbenzene		
534	Naphtogene Blue 4R	1.4-diaminonaphthalene-6-sulphonic acid: 2-naphthylamine-4.8-disulphonic acid: 2.5-diamino-4-methoxytoluene
549 (438)	Diamine Beta Black B	benzidine: 1.7-diamino-8-naphthol-3.6-disulphonic acid
555 (444)	Crumpsall Direct Fast Brown B	benzidine 2.7-diamino-8-naphthol-6-sulphonic acid: 5-amino-2-hydroxybenzoic acid
556 (445)	Crumpsall Direct Fast Brown O	benzidine: 5-amino-2-hydroxybenzoic acid: 2-phenylamino-7-amino-8-naphthol-6-sulphonic acid

	Dye	Other reduction products
4.5-Diamino-1.3-dimethylbenzene		
263 (237)	Bordeaux BX..............	*m*-xylidine: 1-amino-2-naphthol-6-sulphonic acid
264 (238)	Union Fast Claret...........	*m*-xylidine: 1-amino-2-naphthol-3.6-disulphonic acid
4.4′-Diamino-5.5′-dimethyl-2.2′-dimethoxydiphenyl Urea		
349a	Benzo Light Yellow RL......	3-aminobenzoic acid
4.4-Diamono-2.2′-dimethyl Diphenylmethane		
355	Milling Scarlet B............	2-amino-1-naphthol-5-sulphonic acid
2.4-Diaminodiphenylamine		
145 (140)	Indian Yellow R............	1-aminobenzene-4-sulphonic acid
2.4′-Diaminodiphenylamine		
145 (140)	Indian Yellow R............	1-aminobenzene-4-sulphonic acid
4.4′-Diamino-diphenylamine		
145 (140)	Indian Yellow R............	1-aminobenzene-4-sulphonic acid
544	Pluto Black 5BSX...........	1.3-diaminobenzene: 2.7-diamino-8-naphthol-6-sulphonic acid
545	Plutoform Black L..........	3.6-diaminophenylglycine: 2.7-diamino-8-naphthol-6-sulphonic acid
4.4′-Diaminodiphenylmethane		
354 (298)	Milling Red R..............	1-amino-2-naphthol-3.6-disulphonic acid
4.4′-Diaminodiphenylthio Urea		
350	Heligoland Yellow...........	4-aminophenol
351	Salmon Red................	1.2-diaminonaphthalene-4-sulphonic acid
3.3′-Diamino-diphenyl Urea		
352a	Para Fast Brown GK........	1.2.4-triaminobenzene: 1.2.4-triaminobenzene-5-sulphonic acid
4.4.′-Diamino-diphenyl Urea		
346 (296)	Chlorazol Fast Yellow 5GK..	5-amino-2-hydroxybenzoic acid
348	Fast Red...................	2.7-diamino-8-naphthol-3.6-disulphonic acid
6.6′-Diamino-7.7′-disulpho-5.5′-dihydroxydinaphthyl-2.2′-urea (J-acid urea)		
326 (279)	Benzo Fast Orange S........	2-toluidine
326 (279)	Direct Fast Scarlet (TC).....	aniline: 1.4-diaminobenzene
4.4′-Diamino-3.3′-disulpho-diphenyl Urea		
352	Para Fast Brown GR........	1.2.4-triaminobenzene
353 (297)	Benzo Fast Pink 2BL........	1.2-diamino-8-naphthol-6-sulphonic acid
353a	Benzo Fast Eosine BL.......	1.2-diamino-8-naphthol-6-sulphonic acid: 2-phenylamino-6-amino-5-naphthol-7-sulphonic acid
4.4′-Diamino-2.2′-disulpho-stilbene		
358	Hessian Bordeaux...........	1.4-diaminonaphthalene
359 (301)	Hessian Purple N...........	1.2-diaminonaphthalene
360 (302)	Brilliant Hessian Purple......	1.2-diaminonaphthalene-6-sulphonic acid
361	Hessian Purple B............	1.2-diaminonaphthalene-6 and 7-sulphonic acid
362	Hessian Purple D...........	1.2-diaminonaphthalene-5-sulphonic acid
363	Hessian Violet.............	1.4-diaminonaphthalene: 1-amino-2-naphthol
364 (303)	Paper Yellow (TC)..........	4-aminophenol
365 (304)	Chrysophenine G (TC).......	4-phenetidine
366 (305)	Hessian Yellow.............	5-amino-2-hydroxybenzoic acid
620 (9)	Direct Yellow R (TC).......	
621 (11)	Chloramine Orange G (TC)..	
622 (10)	Stilbene Yellow (TC)........	
624 (12)	Diphenyl Citronine G........	aniline
625 (13)	Cotton Brown R............	1.4-diaminobenzene
627 (205)	Diphenyl Chrysoine RR......	1.4-diaminobenzene: 4-phenetidine
628 (206)	Diphenyl Catechine G.......	1.4-diaminobenzene: 2-dimethylamino-7-amino-8-naphthol-6-sulphonic acid
631 (14)	Diphenyl Chrysoine G.......	4-phenetidine
632 (18)	Diphenyl Fast Yellow........	Dehydrothio-*p*-toluidine-sulphonic acid
633 (15)	Chicago Orange R..........	benzidine
634 (16)	Curcuphenine...............	dehydro-thio-*p*-toluidine: 4-toluidine-2-sulphonic acid

	Dye	Other reduction products
4.4′-Diamino-3.3′-ditolylamine		
345 (295)	Diphenyl Fast Black........	2.4.5-triaminotoluene: 2.7-diamino-8-naphthol-6-sulphonic acid
1.7-Diamino-8-hydrazino-naphthalene-3.6-disulphonic Acid		
49 (55)	Brilliant Archil C..........	1.4-diaminobezene
3.5-Diamino-2-hydroxybenzoic Acid		
238 (221)	Anthracene Acid Brown R...	1.4-diaminobenzene: 1-aminobenzene-4-sulphonic acid
2.5-Diamino-4-methoxy-toluene		
325	Diamine Fast Violet........	2.5-aminonaphthol-7-sulphonic acid: 2-phenylamino-6-amino-5-naphthol-7-sulphonic acid
534	Naphtogene Blue 4R........	1.4-diaminonaphthalene-6-sulphonic acid: 2-naphthylamine-4.8-disulphonic acid: 2.5-diamino-1.4-dimethylbenzene
550 (439)	Direct Indigo Blue A........	benzidine: 1.7-diamino-8-naphthol-3.6-disulphonic acid
551 (440)	Direct Indigo Blue BK	benzidine: 2.7-diamino-8-naphthol-6-sulphonic acid
1.4-Diamino-2-ethoxynaphthalene		
310 (268)	Naphthyl Blue Black N......	1.4-diaminonaphthalene: 1-naphthylamine-4.6-(7)-disulphonic acid
314 (271)	Diamine Blue 6G...........	2-naphthylamine-6.8-disulphonic acid: 1-amino-2-naphthol
1.2-Diamino-naphthalene		
22	Oil Yellow AB (TC).........	aniline
61	Oil Yellow OB (TC).........	*o*-toluidine
102	Chrome Olive...............	1.3.5-triamino-2-phenol
335 (287)	Toluylene Orange RR.......	2.6-diaminotoluene-4-sulphonic acid
359 (301)	Hessian Purple N...........	4.4-diamino-2.2-disulpho-stilbene
469 (383)	Naphthazurine B...........	*o*-tolidine: 1.7-diamino-8-naphthol-3.6-disulphonic acid
1.4-Diaminonaphthalene		
267 (241)	Neutral Gray G............	aniline: 2.7-diamino-8-naphthol-6-sulphonic acid
268 (245)	Nyanza Black B...........	1.4-diaminobenzene: 2.7-diamino-8-naphthol-7-sulphonic acid
269 (243)	Coomassie Wool Black R.....	1.4-diaminobenzene: 1-amino-2-naphthol-6-sulphonic acid
270 (244)	Coomassie Wool Black S.....	1.4-diaminobenzene: 1-amino-2-naphthol-3.6-disulphonic acid
289 (257)	Fast Cyanine 5R (TC).......	3-aminobenzene-1-sulphonic acid: 4-amino-1-*p*-tolylnaphthylamine-8-sulphonic acid
290 (258)	Naphthalene Acid Black 4B..	3-aminobenzene-1-sulphonic acid: 1.4-diaminonaphthalene-6 or 7-sulphonic acid
293	Fast Violet R..............	1-aminobenzene-4-sulphonic acid: 1-amino-2-naphthol-6-sulphonic acid
294 (261)	Acid Black 10B (TC)........	1-aminobenzene-3-sulphonic acid: 1.7-diamino-8-naphthol-3.6-disulphonic acid
295 (262)	Victoria Black B...........	1-aminobenzene-4-sulphonic acid: 7-amino-1.8-dihydroxynaphthalene-4-sulphonic acid
296 (263)	Jet Black R...............	aniline-2.4-disulphonic acid: 4-amino-1-phenylnaphthylamine
298	Fast Violet B..............	4-toluidine-3-sulphonic acid: 1-amino-2-naphthol-6-sulphonic acid
299 (275)	Chrome Black F (TC).......	5-amino-2-hydroxybenzoic acid: 2-amino-1-naphthol-5-sulphonic acid
301	Chrome Black I............	5-amino-2-hydroxy-3-sulpho-benzoic acid: 2-amino-1-naphthol-4-sulphonic acid
302 (276)	Diamond Green B..........	5-amino-2-hydroxybenzoic acid: 7-amino-1.8-dihydroxynaphthalene-4-sulphonic acid
304	Fast Acid Black N2B (TC)...	4-aminodiphenylamine-2-sulphonic acid: 4-amino-1-naphthol-6-sulphonic acid

	Dye	Other reduction products
1.4-Diaminonaphthalene—*Continued.*		
305	Nerol B	4-aminodiphenylamine-2-sulphonic acid: 1-amino-2-naphthol-3.6-disulphonic acid
307 (265)	Fast Cyanine Black B (TC)	1-naphthylamine-5-sulphonic acid: 4-amino-1-phenyl-naphthylamine-8-sulphonic acid
308 (266)	Naphthylamine Black D (TC)	1-naphthylamine-3.6-disulphonic acid
309 (267)	Anthracite Black B	1-naphthylamine-3.6-disulphonic acid: 4-amino-1.3-diphenyldiaminobenzene
310 (268)	Naphthyl Blue Black N	1.4-diamino-2-ethoxynaphthalene: 1-naphthylamine-4.6(7)-disulphonic acid
311 (269)	Naphthol Black	1-naphthylamine-4.6(7)-disulphonic acid: 1-amino-2-naphthol-3.6-disulphonic acid
312	Blue Black B	2-naphthylamine-5 and 8-sulphonic acid: 1-amino-2-naphthol-3.6-disulphonic acid
315 (272)	Naphthol Black B	2-naphthylamine-6.8-disulphonic acid: 1-amino-2-naphthol-3.6-disulphonic acid
316 (273)	Diazo Indigo Blue B	1.4-diaminonaphthalene-6(7)-sulphonic acid: 1-amino-2-naphthol-6-sulphonic acid
317 (274)	Diaminogene BX	1.4-diaminonaphthalene-6(7)-sulphonic acid: 2.7-diamino-8-naphthol-6-sulphonic acid
318 (278)	Biebrich Patent Black 4AN	1-naphthylamine-4-sulphonic acid: 1.4-diaminonaphthalene-6(7)-sulphonic acid
319	Brilliant Fast Blue B	1.8-aminonaphthol-3.6-disulphonic acid: 2-phenylamino-6-amino-5-naphthol-7-sulphonic acid
338 (290)	Violet Black	1.4-diamino-benzene: 2-amino-1-naphthol-4-sulphonic acid
358	Hessian Bordeaux	4.4-diamino-2.2-disulpho-stilbene
363	Hessian Violet	4.4-diamino-2.2-disulpho-stilbene: 1-amino-2-naphthol
397	Azo Mauve R	benzidine: 1.7-diamino-8-naphthol-3.6-disulphonic acid
468 (382)	Azo Mauve B	*o*-tolidine: 1.7-diamino-8-naphthol-3.6-disulphonic acid
528 (432)	Naphthylene Violet	1.5-diaminonaphthalene-3.7-disulphonic acid
531	Chrome Patent Green A	aniline: 1.2.7-triamino-8-naphthol-4.6-disulphonic acid: 5-amino-2-hydroxybenzoic acid
535 (435)	Janus Brown B	aniline: 1.2.4.5-tetraminobenzene: 3-aminophenyltrimethylammonium chloride
536 (435)	Janus Brown R	aniline: 1.2.4.5-tetraminobenzene: 4-amino-benzyl-diethylamine
552 (441)	Diazo Blue Black RS	benzidine: 1.7-diamino-8-naphthol-3.6-disulphonic acid
553 (442)	Direct Black V	benzidine: 2.7-diamino-8-naphthol-3.6-disulphonic acid: 2.7-diamino-8-naphthol-6-sulphonic acid
554 (443)	Direct Indone Blue R	benzidine: 2.7-diamino-8-naphthol-3.6-disulphonic acid: 1.7-diamino-8-naphthol-3.6-disulphonic acid.
557 (447)	Benzo Grey S	benzidine: 2-amino-1-naphthol-4-sulphonic acid: 5-amino-2-hydroxybenzoic acid
558 (446)	Benzo Olive	benzidine: 1.7-diamino-8-naphthol-3.6-disulphonic acid: 5-amino-2-hydroxybenzoic acid
566 (450)	Benzo Black Blue R	*o*-tolidine: 2-amino-1-naphthol-4-sulphonic acid
567 (451)	Congo Fast Blue R	*o*-tolidine: 2-amino-1-naphthol-3.8-disulphonic acid
568 (452)	Benzo Indigo Blue	*o*-tolidine: 7-amino-1.8-dihydroxynaphthalene-4-sulphonic acid
576 (456)	Congo Fast Blue B	dianisidine: 2-amino-1-naphthol-3.8-disulphonic acid

	Dye	Other reduction products
1.4-Diaminonaphthalene—*Continued.*		
578 (459)	Benzo Black Blue G	benzidine-3.3-disulphonic acid: 2-amino-1-naphthol-4-sulphonic acid
579 (460)	Benzo Black Blue 5G	benzidine-3.3-disulphonic acid: 7-amino-1.8-dihydroxynaphthalene-4-sulphonic acid
1.5-Diaminonaphthalene		
526	Naphthalene Red	1.2-diaminonaphthalene-4-sulphonic acid
1.2-Diaminonaphthalene-3.6-disulphonic Acid		
129 (120)	Salmon Red	dehydrothio-*m*-xylidine
369 (314)	Pyramine Orange 2R	benzidine:1.2.4.5-tetraminobenzene
377 (315)	Congo Orange G	benzidine: 4-phenetidine
377a	Polar Orange	benzidine: 4-aminophenol: 4-toluene sulphonic acid
378 (316)	Brilliant Congo G	benzidine: 1.2-diaminonaphthalene-6-sulphonic acid
400 (332)	Benzo Fast Red 9BL	benzidine: 1.2-diamino-8-naphthol-6-sulphonic acid
436 (358)	Brilliant Dianol Red R	3.3-dichlorbenzidine
438 (359)	Trypan Red	benzidine-3-sulphonic acid
454 (369)	Brilliant Purpurine R	*o*-tolidine: 1.2-diaminonaphthalene-4-sulphonic acid
455	Brilliant Congo 2R	*o*-tolidine: 1.2-diaminonaphthalene-7-sulphonic acid
456 (370)	Brilliant Congo R	*o*-tolidine: 1.2-diaminonaphthalene-6-sulphohic acid
459 (373)	Congo Orange R	*o*-tolidine: 4-phenetidine
459 (373)	Polar Orange R	*o*-tolidine: 4-aminophenol: toluene-4-sulphonic acid
1.2-Diaminonaphthalene-4.7-disulphonic Acid		
48 (54)	Apollo Red B	1.4-diaminobenzene
1.5-Diaminonaphthalene-3.7-disulphonic Acid		
527 (431)	Diamine Gold	4-phenetidine
528 (432)	Naphthylene Violet	1.2-diaminonaphthalene
1.4-Diaminonaphthalene-monoglycine		
372 (310)	Glycine Corinth	benzidine
373 (309)	Glycine Red	benzidine: 1.2-diaminonaphthalene-4-sulphonic acid
1.2-Diamino-naphthalene-4-sulphonic Acid		
46 (52)	Archil Substitute	1.4-diaminobenzene
108 (91)	Anthracyl Chrome Green A	1.3.5-triamino-2-phenol
351	Salmon Red	4.4-diaminodiphenyl thio urea
367	Congo GR	benzidine: 1-aminobenzene-3-sulphonic acid
373 (309)	Glycine Red	benzidine: 1.4-diaminonaphthalene-monoglycine
374 (311)	Orange TA	benzidine: amino cresol
375 (312)	Congo Corinth G (TC)	benzidine: 2-amino-1-naphthol-4-sulphonic acid
376 (313)	Congo Rubine	benzidine: 1-amino-2-naphthol-8-sulphonic acid
383	Oxamine Scarlet B	benzidine: 1.2.4-triaminobenzene (mono oxamic acid)
415 (340)	Direct Orange R (TC)	benzidine: 5-amino-2-hydroxybenzoic acid
434 (356)	Dianol Red 2B	3.3′-dichlorbenzidine
448 (363)	Benzopurpurine 4B (TC)	*o*-tolidine
453 (368)	Brilliant Purpurine 4B	*o*-tolidine: 1.2-diaminoaphthalene-6-sulphonic acid
454 (369)	Brilliant Purpurine R	*o*-tolidine: 1.2-diaminonaphthalene-3.6-disulphonic acid
460 (374)	Congo Red 4R	Tolidine: 1-amino-2.4-dihydroxybenzene
461 (375)	Congo Corinth B	Tolidine: 2-amino-1-naphthol-4-sulphonic acid
495 (405)	Benzo Purpurine 10B (TC)	Dianisidine
498 (407)	Azo Violet	Dianisidine: 2-amino-1-naphthol-4-sulphonic acid
526	Naphthalene Red	1.5-diaminonaphthalene

	Dye	Other reduction products
1.2-Diaminonaphthalene-5-sulphonic Acid		
47 (53)	Anchil Substitute 3VN.......	1.4-diaminobenzene
362	Hessian Purple D...........	4.4'-diamino-2.2'-disulpho-stilbene
371 (308)	Diazo Black B..............	benzidine
449 (364)	Benzo Purpurine 6B.........	*o*-tolidine
1.2-Diaminonaphthalene-6-sulphonic Acid		
256 (230)	Cloth Red 3G...............	2-toluidine: 2.5-diaminotoluene
340	Chrome Red S...............	1.4-diaminobenzene: 5-amino-2-hydroxybenzoic acid
360 (302)	Brilliant Hessian Purple......	4.4'-diamino-2.2'-disulpho-stilbene
361	Hessian Purple B............	4.4'-diamino-2.2'-disulpho-stilbene: 1.2-diaminonaphthalene-7-sulphonic acid
378 (316)	Brilliant Congo G...........	benzidine: 1.2-diaminonaphthalene-3.6-disulphonic acid
435 (357)	Dianol Red B...............	3.3'-dichlorbenzidine
450 (365)	Benzo Purpurine B..........	*o*-tolidine
451 (366)	Diamine Red B.............	*o*-tolidine: 1.2-diaminonaphthalene-7-sulphonic acid
453 (368)	Brilliant Purpurine 4B.......	*o*-tolidine: 1.2-diaminonaphthalene-4-sulphonic acid
456 (370)	Brilliant Congo R...........	*o*-tolidine: 1.2-diaminonaphthalene-3.6-disulphonic acid
489	Diamine Red NO...........	3-ethoxybenzidine: 1.2-diaminonaphthalene-7-sulphonic acid
1.2-Diaminonaphthalene-7-sulphonic Acid		
361	Hessian Purple B............	4.4'-diamino-2.2'-disulpho-stilbene: 1.2-diaminonaphthalene-6-sulphonic acid
416	Chlorazol Orange 2R.........	benzidine: 5-amino-2-hydroxybenzoic acid
451 (366)	Diamine Red B.............	*o*-tolidine: 1.2-diaminonaphthalene-6-sulphonic acid
452 (367)	Delta Purpurine 7B.........	*o*-tolidine
455	Brilliant Congo 2R..........	*o*-tolidine: 1.2-diaminonaphthalene-3.6-disulphonic acid
457 (371)	Rosazurine R...............	*o*-tolidine: 2-ethylamino-1-naphthylamine-7-sulphonic acid
489	Diamine; Red NO..........	3-ethoxybenzidine: 1.2-diaminonaphthalene-6-sulphonic acid
1.4-Diaminonaphthalene-6-sulphonic Acid		
271 (242)	Sulphone Black G...........	aniline: 7-amino-1.8-dihydroxynaphthalene-4-sulphonic acid
272	Granite Black...............	1.3.5-triamino-2-phenol: 1-amino-2-naphthol
288 (256)	Sulphone Cyanine G.........	aniline: 4-amino-1-phenylnaphthylamine-8-sulphonic acid
290 (258)	Naphthalene Acid Black 4B..	1.4-diaminonaphthalene: 3-aminobenzene-1-sulphonic acid
297	Ingrain Black C.............	1.4-diaminobenzene: 2.7-diamino-8-naphthol-6-sulphonic acid
303 (277)	Anthracene Acid Black.......	5-amino-2-hydroxybenzoic acid: 1-amino-2-naphthol-3.6-disulphonic acid
316 (273)	Diazo Indigo Blue B.........	1.4-diaminonaphthalene: 1-amino-2-naphthol-6-sulphonic acid
317 (274)	Diaminogene BX...........	1.4-diaminonaphthalene: 2.7-diamino-8-naphthol-6-sulphonic acid
318 (278)	Biebrich Patent Black 4AN .	1.4-diaminonaphthalene: 1-naphthylamine-4-sulphonic acid
320	Biebrich Patent Black BO...	1-naphthylamine-3.6-disulphonic acid: 1-amino-2-naphthol-3.6-disulphonic acid
496 (406)	Diazurine B................	dianisidine
532	Diazo Fast Green BL	2.7-diamino-8-naphthol-6-sulphonic acid: amino-1-methyl ketol
533	Diphenyl Fast Blue B........	aniline: 2.6-diamino-5-naphthol-7-sulphonic acid
534	Naphthogene Blue 4R.......	2-naphthylamine-4.8-disulphonic acid: 2.5-diamino-4-methoxytoluene: 2.5-diamino-1.4-dimethylbenzene

	Dye	Other reduction products
1.4-Diaminonaphthalene-6-sulphonic Acid—*Continued.*		
537	Titan Black J..............	1.4-diaminobenzene: 2.6-diamino-5-naphthol-7-sulphonic acid: 1.2.4-triaminobenzene
539 (436)	Direct Fast Black FF (TC)..	1.4-diaminobenzene: 2.7-diamino-8-naphthol-6-sulphonic acid: 1.2.4-triaminobenzene
539 (436)	Direct Fast Black FB (TC)..	1.4-diaminobenzene: 2.7-diamino-8-naphthol-6-sulphonic acid: 2.4.5-triaminotoluene
618 (492)	Anthracene Acid Brown B...	1.2.4.5-tetraminobenzene: 5-amino-2-hydroxybenzoic acid
2.4-Diamino-1-naphthol		
9 (6)	Martius Yellow............	
239 (212)	Fast Brown G..............	1-aminobenzene-4-sulphonic acid
240 (214)	Fast Brown O..............	*m*-4-xylidine-5-sulphonic acid
4.5-Diamino-1-naphthol		
210 (187)	Lanacyl Blue BB...........	1.8-aminonaphthol-3.6-disulphonic acid
1.7-Diamino-8-naphthol-2.4-disulphonic Acid		
512 (419)	Direct Blue RW (TC).......	dianisidine:1-amino-2-naphthol
517 (422)	Chicago Blue 4B...........	dianisidine: 1.7-diamino-8-naphthol-4-sulphonic acid
518 (424)	Direct Pure Blue 6B (TC)...	dianisidine.
1.7-Diamino-8-naphthol-3.5-disulphonic Acid		
475 (389)	Eboli Blue B...............	*o*-tolidine.
1.7-Diamino-8-naphthol-3.6-disulphonic Acid (Amino H-acid)		
30 (41)	Fast Acid Fuchsin G	aniline
31 (42)	Amido Naphthol Red G.....	aniline: acetic acid
57 (66)	Amido Naphthol Red 6B....	1.4-diaminobenzene: acetic acid
99	Palatine Chrome Green G....	1.5-diamino-2-phenol
294 (261)	Acid Black 10B (TC)........	1.4-diaminonaphthalene: 1-aminobenzene-4-sulphonic acid
306 (264)	Fast Acid Black F (TC).....	1-naphthylamine-4-sulphonic acid: 1-amino-2-naphthol
397	Azo Mauve R...............	benzidine: 1.4-diaminonaphthalene
401 (333)	Developed Black BHN (TC).	benzidine: 2.7-diamino-8-naphthol-6-sulphonic acid
402 (334)	Diphenyl Blue Black........	benzidine: 2-ethylamino-7-amino-8-naphthol-6-sulphonic acid
405 (336)	Benzo Cyanine R...........	benzidine: 1.7-diamino-8-naphthol-4-sulphonic acid
406 (337)	Direct Blue 2B (TC)........	benzidine.
467 (381)	Azo Black Blue B...........	*o*-tolidine: 4-amino-3-oxydiphenylamine
468 (382)	Azo Mauve B...............	*o*-tolidine: 1.4-diaminonaphthalene
469 (383)	Naphthazurine B...........	*o*-tolidine: 1.2-diaminonaphthalene
472 (386)	Direct Blue BX (TC)........	*o*-tolidine: 2-amino-1-naphthol-4-sulphonic acid
476 (390)	Congo Cyanine B...........	*o*-tolidine 1.7-diamino-8-naphthol-4-sulphonic acid
477 (391)	Direct Blue 3B (TC)........	*o*-toludine.
519 (425)	Benzo Cyanine 3B...........	dianisidine: 1.7-diamino-8-naphthol-4-sulphonic acid
520 (426)	Direct Pure Blue (TC).......	dianisidine
525 (439)	Indazurine 5GM............	dianisidine: 8-amino-1.7-dihydroxy-2-carboxynaphthalene 4-sulphonic acid
542	Para Bronze NB............	1.3-diaminobenzene: 1-amino-2.4-dihydroxybenzene
549 (438)	Diamine Beta Black B.......	benzidine: 2.5-diamino-1.4-dimethylbenzene
550 (439)	Direct Indigo Blue A........	benzidine: 2.5-diamino-4-methoxytoluene
552 (441)	Diazo Blue Black RS........	benzidine: 1.4-diaminonaphthalene
554 (443)	Direct Indone Blue R........	benzidine: 1.4-diaminonaphthalene: 2.7-diamino-8-naphthol-3.6-disulphonic acid

	Dye	Other reduction products
1.7-Diamino-8-naphthol-3.6-disulphonic Acid (Amino H-acid)—*Continued.*		
558 (446)	Benzo Olive	benzidine: 1.4-diaminonaphthalene: 5-amino-8-hydroxybenzoic acid
559 (448)	Diamine Bronze G	benzidine: 5-amino-2-hydroxybenzoic acid
590 (471)	Chloramine Blue 3G	benzidine: 2.5-dichloraniline: 1.2.7-triamino-8-naphthol-3.5-disulphonic acid
1.7-Diamino-8-naphthol-4.6-disulphonic Acid		
33 (43)	Tolane Red B	aniline
339	Para Black R	1.4-diaminobenzene: 1.2.4-triaminobenzene
404 (335)	Naphthamine Black RE	benzidine: 2.7-diamino-8-naphthol-6-sulphonic acid
407 (338)	Naphthamine Blue 2B	benzidine:
407 (338)	Naphthamine Blue 3B	*o*-tolidine:
418	Diamine Nitrazol G	benzidine: 5-amino-2-hydroxybenzoic acid
531	Chrome Patent Green A	aniline: 1.4-diaminonaphthalene; 5-amino-2-hydroxybenzoic acid
1.2-Diamino-8-naphthol-5-sulphonic Acid		
242 (218)	Nigrophor BASF	2.5-dichloraniline
1.2-Diamino-8-naphthol-6-sulphonic Acid		
353 (297)	Benzo Fast Pink 2BL	4.4′-diamino-3.3′-disulpho-diphenyl urea
353a	Benzo Fast Eosine BL	4.4′-diamino-3.3′-disulpho-diphenyl urea: 2-phenylamino-6-amino-5-naphthol-7-sulphonic acid
394 (327)	Direct Violet N (TC)	benzidine
395 (328)	Diamine Black RO	benzidine: 2.7-diamino-8-naphthol-6-sulphonic acid
400 (332)	Benzo Fast Red 9 BL	benzidine: 1.2-diaminonaphthalene-3.6-disulphonic acid
408	Wool Red G	benzidine: 4-aminophenol-2-sulphonic acid
419 (343)	Direct Fast Red F (TC)	benzidine: 5-amino-2-hydroxybenzoic acid
1.5-Diamino-2-naphthol-4-sulphonic Acid		
203 (183)	Chrome Black T (TC)	4-amino-1-naphthol
204 (184)	Chrome Black A (TC)	1-amino-2-naphthol
1.7-Diamino-8-naphthol-4-sulphonic Acid (Amino S-acid)		
391 (324)	Chicago Blue 4R	benzidine: 1-amino-2-naphthol-8-sulphonic acid
392 (325)	Columbia Blue R	benzidine: 2-amino-1-naphthol-3.8-disulphonic acid
405 (336)	Benzo Cyanine R	benzidine: 1.7-diamino-8-naphthol-3.6-disulphonic acid
470 (384)	Chicago Blue 2R	*o*-tolidine: 1-amino-2-naphthol-8-sulphonic acid
473 (387)	Columbia Blue G	*o*-tolidine: 2-amino-1-naphthol-3.8-disulphonic acid
474 (388)	Chicago Blue R	*o*-tolidine
476 (390)	Congo Cyanine B	*o*-tolidine: 1.7-diamino-8-naphthol-3.6-disulphonic acid
513 (420)	Azidine Wool Blue B	Dianisidine: 1-amino-2-naphthol-8-sulphonic acid
514	Zambesi Black BR	dianisidine: 2.7-diamino-8-naphthol-6-sulphonic acid
516 (423)	Chicago Blue B	dianisidine
517 (422)	Chicago Blue 4B	dianisidine: 1.7-diamino-8-naphthol-2.4-disulphonic acid
519 (423)	Benzo Cyanine, 3B	dianisidine: 1.7-diamino-8-naphthol-3.6-disulphonic acid
2.7-Diamino-8-naphthol-3.6-disulphonic Acid		
34 (44)	Azo Orseille R	aniline
348	Fast Red	4.4′-diaminodiphenyl urea
553 (442)	Direct Black V	benzidine: 1.4-diaminonaphthalene: 2.7-diamino-8-naphthol-6-sulphonic acid
554 (443)	Direct Indone Blue R	benzidine: 1.4-diaminonaphthalene: 1.7-diamino-8-naphthol-3.6-disulphonic acid

	Dye	Other reduction products
2.7-Diamino-8-naphthol-3.6-disulphonic Acid—*Continued.*		
561 (449)	Chlorazol Brown LF	benzidine: 1-naphthylamine-4-sulphonic acid: 2.3.4.5-tetraminotoluene: 5-amino-2-hydroxybenzoic acid
569 (453)	Columbia Black R	o-tolidine: 2.4.5-triaminotoluene
570 (454)	Trisulphone Brown G	o-tolidine: 2.3.4.5-tetraminotoluene: 5-amino-2-hydroxybenzoic acid: 2.7-diamino-8-naphthol-3.6-disulphonic acid
575 (455)	Columbia Black B	dianisidine: 2.4.5-tetraminotoluene
577 (457)	Trisulphone Brown 2G	dianisidine: 2.4.5-tetraminotoluene: 5-amino-2-hydroxybenzoic acid
1.6-Diamino-5-naphthol-7-sulphonic Acid		
424 (345)	Oxamine Maroon	Benzidine: 5-amino-2-hydroxybenzoic acid
515 (421)	Niagara Black R	dianisidine: 2-amino-1-naphthol-4-sulphonic acid
2.4-Diamino-1-naphthol-7-sulphonic Acid		
10 (7)	Naphthol Yellow S (TC)	
2.6-Diamino-5-naphthol-7-sulphonic Acid (Amino J-acid)		
393 (326)	Oxamine Violet	benzidine
425 (346)	Oxamine Red	benzidine: 5-amino-2-hydroxybenzoic acid
471 (385)	Benzo Azurine 3R	o-tolidine: 2-amino-1-naphthol-4-sulphonic acid
533	Diphenyl Fast Blue B	aniline: 1.4-diaminonaphthalene-6-sulphonic acid
537	Titan Black J	1.4-diaminobenzene: 1.4-diaminonaphthalene-6-sulphonic acid: 1.2.4-triaminobenzene
543	Diamine Fast Bordeaux	1.3-diaminobenzene: 1-amino-2.4-dihydroxybenzene
2.7-Diamino-8-naphthol-6-sulphonic Acid		
205	Ponceau 3R	1-amino-2-naphthol-8-sulphonic acid
267 (241)	Neutral Gray G	aniline: 1.4-diaminonaphthalene
268 (245)	Nyanza Black B	1.4-diaminobenzene: 1.4-diaminonaphthalene
297	Ingrain Black C	1.4-diaminobenzene: 1.4-diaminonaphthalene-6-sulphonic acid
317 (274)	Diaminogene BX	1.4-diaminonaphthalene: 1.4-diaminonaphthalene-6(7)-sulphonic acid
345 (295)	Diphenyl Fast Black	2.4.5-triaminotoluene: 4.4′-diamino-3.3′-ditolylamine
395 (328)	Diamine Black RO	benzidine: 1.2-diamino-8-naphthol-6-sulphonic acid
396 (329)	Diamine Brown V	benzidine: 1.2.4-triaminobenzene
398 (330)	Zambesi Brown G	benzidine: 1.2.7-triaminonaphthalene-3.6-disulphonic acid
401 (333)	Developed Black BHN (TC)	benzidine: 1.7-diamino-8-naphthol-3.6-disulphonic acid
404 (335)	Naphthamine Black RE	benzidine: 1.7-diamino-8-naphthol-4.6-disulphonic acid
420 (344)	Direct Brown M (TC)	benzidine: 5-amino-2-hydroxybenzoic acid
485 (399)	Indazurine TS	o-tolidine: 8-amino-1.7-dihydroxy-2-carboxynaphthalene-4-sulphonic acid
492 (402)	Diamine Blue Black E	3-ethoxybenzidine: 1-amino-2-naphthol-3.7-disulphonic acid
493 (403)	Diamine Black BO	3-ethoxybenzidine
514	Zambesi Black BR	dianisidine: 1.7-diamino-8-naphthol-4-sulphonic acid
532	Diazo Fast Green BL	1.4-diaminonaphthalene-6-sulphonic acid: amino-1-methyl ketol
538	Oxydiamine Black B	1.4-diaminobenzene: 1.2.4-triaminobenzene
539 (436)	Direct Fast Black FF (TC)	1.4-diaminobenzene: 1.4-diamionaphthalene-6-sulphonic acid: 1'2.4-triaminobenzene
539 (436)	Direct Fast Black FB (TC)	1.4-diaminobenzene: 1.4-diaminonaphthalene-6-sulphonic acid: 2.4.5-triaminotoluene
540 (437)	Isodiphenyl Black R	1.4-diaminobenzene: 1.2.4-triaminobenzene: 1-amino-2.4-dihydroxybenzene
544	Pluto Black 5 BSX	1.3-diaminobenzene: 4.4-diaminodiphenylamine

	Dye	Other reduction products
2.7-Diamino-8-naphthol-6-sulphonic Acid—*Continued.*		
545	Plutoform Black L	3.6-diaminophenyl glycine: 4.4-diamino-diphenylamine
547	Oxamine Black MB	benzidine: 1.2.4-triaminobenzene (mono-oxamic acid)
551 (440)	Direct Indigo Blue BK	benzidine: 2.5-diamino-4-methoxytoluene
553 (442)	Direct Black V	benzidine: 1.4-diaminonaphthalene: 2.7-diamino-8-naphthol-3.6-disulphonic acid
555 (444)	Crumpsall Direct Fast Brown B	benzidine: 2.5-diamino-1.4-dimethylbenzene: 5-amino-2-hydroxybenzoic acid
560	Cotton Dark Brown T	benzidine: 5-amino-2-hydroxybenzoic acid: 1.2.4-triaminobenzene
562	Oxamine Black MT	o-tolidine: 1.2.4-triaminobenzene (mono oxamic acid)
572	Oxamine Black MO	dianisidine: 1.2.4-triaminobenzene (mono oxamic acid)
577 (457)	Trisulphone Brown 2G	dianisidine: 1-naphthylamine-4-sulphonic acid: 2.3.4.5-tetraminotoluene: 5-amino-2-hydroxybenzoic acid
591 (472)	Chloramine Blue HW	benzidine: 2.5-dichloraniline: 1.2.7-triamino-8-naphthol-3.6-disulphonic acid
617 (491)	Dianil Black PR	benzidine-3.3-disulphonic acid: 1.2.4-triaminobenzene
3.4-Diamino-phenetole		
123	Nitrophenetidine Red	1-amino-2-naphthol
Diamino-2-phenols		
100 (87)	Peri Wool Blue B, G	2-amino-1.8-dihydroxynaphthalene-3.6-disulphonic acid
1.5-Diamino-2-phenol		
98	Palatine Chrome Brown 2G	1.2.4-triaminobenzene-5-sulphonic acid
99	Palatine Chrome Green G	1.7-diamino-8-naphthol-3.6-disulphonic acid
2.5-Diamino-phenol		
106 (90)	Chrome Brown P	1.3.5-triamino-2-phenol
1.4-Diamino-2-phenol-5-sulphonic Acid		
141	Phenoflavine	1-aminobenzene-3-sulphonic acid
2.5-Diaminophenol-4-sulphonic Acid		
409 (339)	Brilliant Orange G	benzidine: 5-amino-2-hydroxybenzoic acid
2.6-Diaminophenol-4-sulphonic Acid		
172 (150)	Acid Alizarine Black R	1-amino-2-naphthol (1 Mol.)
336 (288)	Acid Alizarine Black SE	1-amino-2-naphthol (2 Mol.)
337 (289)	Acid Alizarine Black SN	1-amino-2-naphthol: 1-amino-2-naphthol-6-sulphonic acid
3.4-Diaminophenol-6-sulphonic Acid		
602 (481)	Azo Corinth	o-tolidine: 1-naphthylamine-4-sulphonic acid: 2.4-diamino-1.3-dihydroxybenzene
3.6-Diaminophenyl glycine		
545	Plutoform Black L	4.4′-diaminodiphenylamine: 2.7-diamino-8-naphthol-6-sulphonic acid
4.4′-Diamino-2.5.2′-5′-tetramethyldiphenylmethane		
356 (299)	Cinnabar Scarlet BF	1-amino-2-naphthol-3.6-disulphonic acid
4.4′-Diamino-2.2′-5.5′-tetramethyl-triphenylmethane		
357 (300)	Cotton Ponceau	1-amino-2-naphthol-3.6-disulphonic acid
4.4-Diamino-thio diphenyl		
343 (294)	Anthracene Yellow C	5-amino-2-hydroxybenzoic acid
344 (293)	Milling Red G	1-amino-2-naphthol-6-sulphonic acid
2.4-Diamino-toluene		
68 (72)	Pigment Orange R	1-amino-2-naphthol
332 (284)	Bismarck Brown 2R (TC)	2.4.5-triaminotoluene
604 (483)	St. Denis Direct Red	2-amino-1-naphthol-4-sulphonic acid
605 (484)	Milling Scarlet B	2-amino-1-naphthol-4-sulphonic acid: 1-amino-2-naphthol-3.6-disulphonic acid

	Dye	Other reduction products
2.5-Diaminotoluene		
17 (68)	Spirit Yellow R (TC)........	2-toluidine
256 (230)	Cloth Red 3G...............	2-toluidine: 1.2-diaminonaphthalene-6-sulphonic acid
257 (231)	Cloth Red 3BX............	toluidine: 1-amino-2-ethylnaphthylamine-7-sulphonic acid
258 (232)	Sudan IV (TC).............	toluidine: 1-amino-2-naphthol
259 (233)	Cloth Red B (TC)..........	toluidine: 2-amino-1-naphthol-4-sulphonic acid
260 (235)	Croceine 3B...............	toluidine: 2-amino-1-naphthol-4.8-disulphonic acid
261 (234)	Cloth Red G...............	toluidine: 1-amino-2-naphthol-6-sulphonic acid
262 (236)	Cloth Red 2B (TC)..........	toluidine: 1-amino-2-naphthol-3.6-disulphonic acid
266 (240)	Janus Red B...............	1-amino-2-naphthol: 3-aminophenyltrimethylammonium chloride
283 (252)	Cloth Scarlet R............	2-toluidine-5-sulphonic acid: 1-amino-2-naphthol
284 (253)	Orseilline BB..............	2-toluidine-5-sulphonic acid: 2-amino-1-naphthol-4-sulphonic acid
285 (254)	Bordeaux G...............	2-toluidine-5-sulphonic acid: 1-amino-2-naphthol-6-sulphonic acid
286 (255)	Croceine Scarlet 8B.........	2-toluidine-5-sulphonic acid: 1-amino-2-naphthol-8-sulphonic acid
313 (270)	Brilliant Croceine 9B........	2-naphthylamine-6.8-disulphonic acid: 1-amino-2-naphthol-3.6-and 6.8-disulphonic acids
3.4-Diamino-toluene		
69 (73)	Lithol Fast Scarlet R........	1-amino-2-naphthol
70	Rapid Fast Red GL.........	1-amino-2-oxy-3-naphthonic acid anilid
2.5-Diaminotoluene-3-sulphonic Acid		
18 (149)	Fast Yellow R..............	2-toluidine-5-sulphonic acid
2.6-Diaminotoluene-4-sulphonic Acid		
333 (285)	Toluylene Brown G..........	1.2.4-triaminobenzene
334 (286)	Toluylene Yellow...........	1.2.4.5-tetraminobenzene or 1.2.4-triamino-5-nitrobenzene (partial reduction)
335 (287)	Toluylene Orange RR........	1.2-diaminonaphthalene
609 (488)	Toluylene Brown R..........	1.2.4.5-tetraminobenzene: 1-naphthylamine-4-sulphonic acid
Dianisidine		
494	Oxamine Black BR..........	2-amino-1-naphthol-4-sulphonic acid: 1.2.4-triaminobenzene (mono oxamic acid)
495 (405)	Benzo Purpurine 10B (TC)...	1.2-diaminonaphthalene-4-sulphonic acid
496 (406)	Diazurine B................	1.4-diaminonaphthalene-6-sulphonic acid
497	Heliotrope B...............	2-ethylamino-1-naphthylamine-7-sulphonic acid
498 (407)	Azo Violet..................	1.2-diaminonaphthalene-4-sulphonic acid: 2-amino-1-naphthol-4-sulphonic acid
501 (409)	Trisulphone Blue B..........	1-amino-2-naphthol: 2-amino-1-naphthol-3.6.8-trisulphonic acid
502 (410)	Direct Azurine G (TC).......	2-amino-1-naphthol-4-sulphonic acid
503 (411)	Benzo Azurine 3G...........	2-amino-1-naphthol-5-sulphonic acid
504 (412)	Congo Blue 2B.............	2-amino-1-naphthol-4-sulphonic acid: 1-amino-2-naphthol-3.6-disulphonic acid
505	Titan Blue 3B..............	2-amino-1-naphthol-4.7-disulphonic acid: 1-amino-2-naphthol-3.6-disulphonic acid
506 (413)	Direct Violet BB...........	8-amino-1.7-dihydroxynaphthalene-4-sulphonic acid: 2.4.5-triaminotoluene
507 (414)	Indazurine B...............	8-amino-1.7-dihydroxynaphthalene-4-sulphonic acid: 1-amino-2-naphthol-3.6-disulphonic acid
508 (415)	Dianil Blue G..............	2-amino-1.8-dihydroxynaphthalene-3.6-disulphonic acid
509 (416)	Brilliant Azurine 5G........	7-amino-1.8-dihydroxynaphthalene-4-sulphonic acid
510 (417)	Chlorazol Brilliant Blue 8B.	2-amino-1-naphthol-8-chlor-5-sulphonic acid
511 (418)	Brilliant Azurine B..........	2-amino-1-naphthol-8-chlor-3.6-disulphonic acid

	Dye	Other reduction products
Dianisidine—*Continued.*		
512 (419)	Direct Blue RW (TC).......	1.7-diamino-8-naphthol-2.4-disulphonic acid: 1-amino-2-naphthol
513 (420)	Azidine Wool Blue B........	1-amino-2-naphthol-8-sulphonic acid: 1.7-diamino-8-naphthol-4-sulphonic acid
514	Zambesi Black BR..........	2.7-diamino-8-naphthol-6-sulphonic acid: 1.7-diamino-8-naphthol-4-sulphonic acid
515 (421)	Niagara Blue R............	1.6-diamino-5-naphthol-7-sulphonic acid: 2-amino-1-naphthol-4-sulphonic acid
516 (423)	Chicago Blue B............	1.7-diamino-8-naphthol-4-sulphonic acid:
517 (422)	Chicago Blue 4B...........	1.7-diamino-8-naphthol-4-sulphonic acid: 1.7-diamino-8-naphthol-2.4-disulphonic acid
518 (424)	Direct Pure Blue 6B (TC)....	1.7-diamino-8-naphthol-2.4-disulphonic acid
519 (425)	Benzo Cyanine 3B..........	1.7-diamino-8-naphthol-3.6-disulphonic acid: 1.7-diamino-8-naphthol-4-sulphonic acid
520 (426)	Direct Pure Blue (TC).......	1.7-diamino-8-naphthol-3.6-disulphonic acid
522 (427)	Indazurine GM.............	8-amino-1.7-dihydroxy-2-carboxynaphthalene-4-sulphonic acid: 2-amino-1-naphthol-4-sulphonic acid
523 (428)	Direct Blue B..............	8-amino-1.7-dihydroxy-6-carboxynaphthalene-3-sulphonic acid: 2-amino-1-naphthol-4-sulphonic acid
524 (429)	Indazurine BB..............	8-amino-1.7-dihydroxy-2-carboxynaphthalene-4-sulphonic acid: 1-amino-2-naphthol-3.6-disulphonic acid
525 (430)	Indazurine 5GM............	8-amino-1.7-dihydroxy-2-carboxynaphthalene-4-sulphonic acid: 1.7-diamino-8-naphthol-3.6-disulphonic acid
571	Oxamine Blue BB..........	1.2.4-triaminobenzene: 1-amino-2-naphthol: 2-amino-1-naphthol-4-sulphonic acid
572	Oxamine Black MO.........	1.2.4-triaminobenzene (mono oxamic acid): 2.7-diamino-8-naphthol-6-sulphonic acid
573	Ozamine Blue BT...........	1.2.4-triaminobenzene and Mono oxamic acid: 1-amino-2-naphthol-3.6-disulphonic acid
574	Oxamine Blue MD..........	1.2.4-triaminobenzene (mono oxamic acid): 1-amino-2-naphthol-3.6-disulphonic acid
575 (455)	Columbia Black B..........	2.4.5-triaminotoluene: 2.7-diamino-8-naphthol-3.6-disulphonic acid
576 (456)	Congo Fast Blue B..........	1.4-diaminonaphthalene: 2-amino-1-naphthol-3.8-disulphonic acid
577 (457)	Trisulphone Brown 2G.......	2.7-diamino-8-naphthol-3.6-disulphonic acid: 2.3.4.5-tetraminotoluene: 1-naphthylamine-4-sulphonic acid: 5-amino-2-hydroxybenzoic acid
2.5-Dichloraniline		
242 (218)	Nigrophor BASF............	1.2-diamino-8-naphthol-5-sulphonic acid
588 (469)	Chloramine Black N.........	benzidine: 1.2.7-triamino-8-naphthol-3.6-disulphonic acid: 1.2.4-triaminobenzene
589 (470)	Chloramine Green B (TC)....	benzidine: 1.2.7-triamino-8-naphthol-3.6-disulphonic acid: 4-aminophenol
590 (471)	Chloramine Blue 3G.........	benzidine: 1.2.7-triamino-8-naphthol-3.6-disulphonic acid: 1.7-diamino-8-naphthol-3.6-disulphonic acid
591 (472)	Chloramine Blue HW........	benzidine: 2.7-diamino-8-naphthol-6-sulphonic acid: 1.2.7-triamino-8-naphthol-3.6-disulphonic acid
3.3′-Dichlor-benzidine		
434 (356)	Dianol Red 2B.............	1.2-diaminonaphthalene-4-sulphonic acid
435 (357)	Dianol Red B..............	1.2-diaminonaphthalene-6-sulphonic acid
436 (358)	Brilliant Dianol Red R.......	1.2-diaminonaphthalene-3.6-disulphonic acid

	Dye	Other reduction products
2-Dimethylamino-7-amino-8-naphthol-6-sulphonic Acid		
422 (348)	Diphenyl Brown BN........	benzidine: 5-amino-2-hydroxybenzoic acid
479 (393)	Diphenyl Brown 3GN.......	o-to'lidine: 5-ami'no-2-hydroxybenzoic acid
628 (206)	Diphenyl Catechine G.......	4.4-diamino-2.2-disulpho-stilbene: 1.4-diaminobenzene
3-Ethoxy-benzidine		
488 (404)	Diamine Yellow N..........	5-amino-2-hydroxybenzoic acid: 4-phenetidine
489	Diamine Red NO...........	1.2-diaminonaphthalene-6 and 7-sulphonic acids
490 (401)	Diamine Blue 3R...........	2-amino-1-naphthol-4-sulphonic acid
491	Diamine Blue B.............	2-amino-1-naphthol-4-sulphonic acid: 1-amino-2-naphthol-3.7-disulphonic acid
492 (402)	Diamine Blue Black E.......	2.7-diamino-8-naphthol-6-sulphonic acid: 1-amino-2-naphthol-3.7-disulphonic acid
493 (403)	Diamine Black BO..........	2.7-diamino-8-naphthol-6-sulphonic acid:
2-Ethylamino-1-naphthylamine-7-sulphonic Acid		
457 (371)	Rosazurine R...............	o-tolidine: 1.2-diamino-naphthalene-7-sulphonic acid
458 (372)	Rosazurine B...............	o-tolidine
497	Heliotrope B................	dianisidine
2.2'.4.4'.6.6'-hexamino-diphenylamine		
12	Aurantia	
***p*-Hydroxy-phenyl-toluene-triazol carboxylic Acid (M. P. 276°)**		
67	Persian Yellow	
2-methylamino-7-amino-8-naphthol-6-sulphonic Acid		
421 (347)	Diphenyl Brown RN........	benzidine: 5-amino-2-hydroxybenzoic acid
1-Naphthylamine		
81 (105)	Pigment Brown.............	2-amino-1-naphthol
82 (106)	Naphthylamine Claret.......	1-amino-2-naphthol
83 (107)	Naphthine Brown A.........	1-amino-2-naphthol
84 (108)	Double Ponceau R..........	2-amino-1-naphthol-5-sulphonic acid
85 (109)	Palatine Red A.............	2-amino-1-naphthol-3.6-disulphonic acid
86 (110)	Buffalo Rubine..............	2-amino-1-naphthol-4.8-disulphonic acid
87 (111)	Fast Red BT...............	1-amino-2-naphthol-6-sulphonic acid
88 (112)	Bordeaux B (TC)...........	1-amino-2-naphthol-3.6-disulphonic acid
89 (113)	Crystal Ponceau............	1-amino-2-naphthol-6.8-disulphonic acid
90 (114)	Chromotrope 10B...........	2-amino-1.8-dioxy-naphthalene-3.6-disulphonic acid
241 (220)	Wool Black 4B..............	1-aminobenzene-4-sulphonic acid: 1.2.7-triamino-8-naphthol-4-sulphonic acid
2-Naphthylamine		
91	Palatine Scarlet 3R..........	2-amino-1-naphthol-3.6-disulphonic acid
93 (115)	Azo Turkish Red............	1-amino-2-naphthol
1-naphthylamine-3.6-disulphonic Acid		
308 (266)	Naphthylamine Black D (TC)	1.4-diaminonaphthalene
309 (267)	Anthracite Black B..........	1.4-diaminonaphthalene: 4-amino-1.3-diphenyldiaminobenzene
320	Biebrich Patent Black BO.. .	1.4-diaminonaphthalene-6(7)-sulphonic acid: 1-amino-2-naphthol-3.6-disulphonic acid
1-Naphthylamine-4.6-disulphonic Acid		
310 (268)	Naphthyl Blue Black B......	1.4-diaminonaphthalene: 1.4-diamino-2-ethoxynaphthalene
311 (269)	Naphthol Black.............	1.4-diaminonaphthalene: 1-amino-2-naphthol-3.6-disulphonic acid
1-Naphthylamine-4.7-disulphonic Acid		
310 (268)	Naphthyl Blue Black B......	See 4.6-disulphonic acid
311 (269)	Naphthol Black.............	
2-Naphthylamine-1.6-disulphonic Acid		
200	Heliopurpurine 7 BL........	1-amino-2-naphthol-3.6-disulphonic acid
2-Naphthylamine-3.6-disulphonic Acid		
198	Heliopurpurine 4BL.........	2-amino-1-naphthol-3.6-disulphonic acid
199	Heliopurpurine GL..........	1-amino-2-naphthol-3.6.8-trisulphonic acid

	Dye	Other reduction products
2-Naphthylamine-4.8-disulphonic Acid		
534	Naphtogene Blue 4R........	1.4-diaminonaphthalene-6-sulphonic acid: 2.5-diamino-4-methoxytoluene: 2.5-diamino-1.4-dimethylbenzene
2-Naphthylamine-6.8-disulphonic Acid		
197 (178)	Solochrome Yellow Y........	5-amino-2-hydroxybenzoic acid
313 (270)	Brilliant Croceine 9B........	2.5-diaminotoluene: 1-amino-2-naphthol-3.6-and-6.8-disulphonic acid
314 (271)	Diamine Blue 6G............	1.4-diamino-2-ethoxynaphthalene: 1-amino-2-naphthol
315 (272)	Naphthol Black B...........	1.4-diaminonaphthalene; 1-amino-2-naphthol-3.6-disulphonic acid
1-Naphthylamine-4-sulphonic Acid		
175 (160)	Acid Brown R..............	4-amino-1-naphthol
176 (161)	Fast Red A.................	1-amino-2-naphthol
179 (163)	Azo Rubine (TC)...........	2-amino-1-naphthol-4-sulphonic acid
180 (164)	Fast Red VR (TC)..........	2-amino-1-naphthol-5-sulphonic acid
181 (165)	Azo Red A.................	2-amino-1-naphthol-3.6-disulphonic acid
182 (166)	Fast Red E................	1-amino-2-naphthol-6-sulphonic acid
183 (167)	Crocein Scarlet 3BX.........	1-amino-2-naphthol-8-sulphonic acid
184 (168)	Amaranth (TC)..............	1-amino-2-naphthol-3.6-disulphonic acid
185 (169)	Cochineal Red (TC).........	1-amino-2-naphthol-6.8-disulphonic acid
186 (170)	Ponceau 6R................	1-amino-2-naphthol-3.6.8-trisulphonic acid
188 (171)	Chromotrope 8B............	2-amino-1.8-dihydroxynaphthalene-3.6-disulphonic acid
231 (209)	Clayton Cotton Brown.......	1.2.4.5-tetraminobenzene, Primuline
232	Acid Brown R..............	aniline: 1.2.4.5.-tetraminobenzene
235 (213)	Resorcine Dark Brown (TC)	2.4-diamino-1.3-dihydroxybenzene
306 (264)	Fast Acid Black F (TC).....	1.7-diamino-8-naphthol-3.6-disulphonic acid: 1-amino-2-naphthol
318 (278)	Biebrich Patent Black 4AN..	1.4-diaminonaphthalene: 1.4-diaminonaphthalene-6(7)-sulphonic acid
561 (449)	Chlorazol Brown LF.........	benzidine: 2.7-diamino-8-naphthol-3.6-disulphonic acid: 2.3.4.5-tetraminotoluene: 5-amino-2-hydroxybenzoic acid
570 (454)	Trisulphone Brown G........	*o*-tolidine: 2.3.4.5-tetraminotoluene: 2.7-diamino-8-naphthol-3.6-disulphonic acid: 5-amino-2-hydroxybenzoic acid
577 (457)	Trisulphone Brown 2G.......	dianisidine: 2.3.4.5-tetraminotoluene: 2.7-diamino-8-naphthol-3.6-disulphonic acid: 5-amino-2-hydroxybenzoic acid
597	Dianil Chrome Brown R.....	benzidine: 1.2.4.5-tetraminobenzene: 5-amino-2-hydroxybenzoic acid
600 (479)	Dianil Black R.............	benzidine: 1.2.4-triaminobenzene: 2.7-diamino-1.8-dihydroxynaphthalene-3.6-disulphonic acid
602 (481)	Azo Corinth...............	*o*-tolidine: 2.4-diamino-1.3-dihydroxybenzene: 3.4-diaminophenol-6-sulphonic acid
608 (487)	Direct Brown B (TC)........	1.3-diaminobenzene: 1.2.4.5-tetraminobenzene
609 (488)	Toluylene Brown R..........	1.2.4-tetraminobenzene: 2.6-diaminotoluene-4-sulphonic acid
612 (490)	Cotton Brown A............	benzidine: 1.2.4.5-tetraminobenzene
1-Naphthylamine-5-sulphonic Acid		
177 (162)	Brilliant Fast Red G........	1-amino-2-naphthol
307 (265)	Fast Cyanine Black B (TC)..	1.4-diaminonaphthalene: 4-amino-1-phenylnaphthylamine-8-sulphonic acid
601 (480)	Congo Brown R............	benzidine: 2.4-diamino-1.3-dihydroxybenzene: 5-amino-2-hydroxybenzoic acid
2-Naphthylamine-1-sulphonic Acid		
189 (173)	Lithol Red R (TC)..........	1-amino-2-naphthol
190 (179)	Lake Bordeaux B...........	1-amino-2-naphthol-3-carboxylic acid
2-Naphthylamine-5-sulphonic Acid		
191	Pyrotine RRO.............	2-amino-1-naphthol-4-sulphonic acid

	Dye	Other reduction products
2-Naphthylamine-5-sulphonic Acid—*Continued.*		
196 (175)	Acid Ponceau DH	1-amino-2-naphthol: 2-naphthylamine-8-sulphonic acid
312	Blue Black B	1.4-diaminonaphthalene: 1-amino-2-naphthol-3.6-disulphonic acid: 2-naphthylamine-8-sulphonic acid
2-Naphthylamine-6-sulphonic Acid		
192 (172)	Fast Brown 3B	4-amino-1-naphthol
193 (174)	Double Brilliant Scarlet G	1-amino-2-naphthol
194 (176)	Double Brilliant Scarlet S	2-amino-1-naphthol-4-sulphonic acid
195 (177)	Mordant Yellow (TC)	5-amino-2-hydroxybenzoic acid
2-Naphthylamine-8-sulphonic Acid		
196 (175)	Acid Ponceau DH	1-amino-2-naphthol; 2-naphthylamine-5-sulphonic acid
312	Blue Black B	1.4-diaminonaphthalene: 2-naphthylamine-5-sulphonic acid: 1-amino-2-naphthol-3.6-disulphonic acid
6-Nitro-2-aminophenol-4-sulphonic Acid (by Partial Reduction)		
172 (159)	Acid Alizarine Black R	1-amino-2-naphthol
3-Nitro-4-toluidine (By Partial Reduction)		
69 (73)	Fast Red G Base	
69 (73)	Lithol Fast Scarlet R	1-amino-2-naphthol
70	Rapid Fast Red GL	1-amino-2-oxy-3-naphthoic acid anilid
4-Nitro-2-toluidine (By Partial Reduction)		
68 (72)	Fast Scarlet G Base	
68 (72)	Pigment Orange R	1-amino-2-naphthol
4-Phenetid'ne		
122	Erio Chrome Yellow 6G	5-amino-2-hydroxybenzoic acid
365 (304)	Chrysophenine G (TC)	4.4-diamino-2.2-disulpho-stilbene
377 (315)	Congo Orange G	Benzidine: 1.2-diaminonaphthalene-3.6-disulphonic acid
382 (319)	Diamine Scarlet B	benzidine: 1-amino-2-naphthol-6.8-disulphonic acid
382 (319)	Diamine Scarlet 3B	*o*-tolidine: 1-amino-2-naphthol-6.8-disulphonic acid
459 (373)	Congo Orange R	*o*-tolidine: 1.2-diaminonaphthalene-3.6-disulphonic acid
488 (404)	Diamine Yellow N	3-ethoxybenzidine: 5-amino-2-hydroxybenzoic acid
527 (431)	Diamine Gold	1.5-diaminonaphthalene-3.7-disulphonic acid
627 (205)	Diphenyl Chrysoine RR	4.4-diamino-2.2-disulpho-stilbene: 1.4-diaminobenzene
631 (14)	Diphenyl Chrysoine G	4.4-diamino-2.2-disulpho-stilbene.
2-Phenylamino-6-amino-5-naphthol-7-sulphonic Acid (Amino Phenyl. J-acid)		
319	Brilliant Fast Blue B	1.4-diaminonaphthalene: 1.8-aminonaphthol-3.6-disulphonic acid
325	Diamine Fast Violet	2.5-diamino-4-methoxytoluene: 2.5-aminonaphthol-7-sulphonic acid
353a	Benzo Fast Eosine BL	4.4-diamino-3.3-disulpho-diphenyl urea: 1.2-diamino-8-naphthol-6-sulphonic acid
2-Phenylamino-7-amino-8-naphthol-6-sulphonic Acid		
423 (349)	Chlorazol Brown B	benzidine: 5-amino-2-hydroxybenzoic acid
556 (445)	Crumpsall Direct East Brown O	benzidine: 5-amino-2-hydroxybenzoic acid: 2.5-diamino-1.4-dimethylbenzene
Primuline (Sulphonic Acid)		
220 (190)	Benzo Brown 5R	1.2.4-triaminobenzene
221 (191)	Pyramine Yellow R	1.2.3.4-tetraminobenzene
222 (192)	Cotton Orange G	1.2.3-triaminobenzene-4.6-disulphonic acid
227 (195)	Direct Scarlet SG (TC)	2-amino-1-naphthol-4-sulphonic acid
228 (197)	Direct Scarlet G (TC)	1-amino-2-naphthol-6-sulphonic acid
231 (209)	Clayton Cotton Brown	1.2.4.5-tetraminobenzene: 1-naphthylamine-4-sulphonic acid
233 (210)	Cotton Orange R	3-aminobenzene sulphonic acid: 1.2.3.5-tetraminobenzene-4.6-disulphonic acid

	Dye	Other reduction products
Primuline (Sulphonic Acid)—*Continued.*		
646	Dianil Orange G	4-amino-1-(4-sulphobenzene)-5-pyrazolone-3-carboxylic acid
647	Dianil Yellow 3G	Amino-aceto acetic ester
648	Dianil Yellow 3 GN	amino-aceto acetic-anilide
649 (26)	Dianil Yellow R	4-amino-1-phenyl-3-methyl-5-pyrazolone
650 (27)	Dianil Yellow 2R	4-amino-1-(4-sulphobenzene)-3-methyl-5-pyrazolone
Safranine		
133 (124)	Janus Green B	4-amino-dimethylaniline
134 (125)	Diazine Black	4-amino-phenol
135 (126)	Janus Blue G, R	1-amino-2-naphthol
1.2.4.5-Tetraminobenzene		
230 (208)	Leather Brown	1.4-diaminobenzene
231 (209)	Clayton Cotton Brown	primuline: 1-naphthylamine-4-sulphonic acid
232	Acid Brown R	aniline: 1-naphthylamine-4-sulphonic acid
334 (286)	Toluylene Yellow	2.6-diaminotoluene-4-sulphonic acid
368 (306)	Pyramine Orange 3G	benzidine: 1.2.3-triaminobenzene-4.6-disulphonic acid
369 (314)	Pyramine Orange 2R	benzidine: 1.2-diaminonaphthalene-3.6-disulphonic acid
440 (360)	Pyramine Orange R	benzidine-3.3-disulphonic acid
535 (435)	Janus Brown B	aniline: 1.4-diaminonaphthalene: 3-aminophenyl-trimethylammonium chloride
536 (435)	Janus Brown R	aniline: 1.4-diaminonaphthalene: 4-aminobenzyl-diethylamine
596 (476)	Direct Brown 3GO (TC)	benzidine: 1-aminobenzene-4-sulphonic acid: 5-amino-2-hydroxybenzoic acid
597	Dianil Chrome Brown R	benzidine: 1-naphthylamine-4-sulphonic acid: 5-amino-2-hydroxybenzoic acid
606 (485)	Direct Brown G (TC)	1.3-diaminobenzene: 1-aminobenzene-4-sulphonic acid
607 (486)	Direct Brown J	1.3-diaminobenzene: 3-amino-1-benzoic acid
608 (487)	Direct Brown B (TC)	1.3-diaminobenzene: 1-naphthylamine-4-sulphonic acid
609 (488)	Toluylene Brown R	2.6-diaminotoluene-4-sulphonic acid: 1-naphthylamine-4-sulphonic acid
612 (490)	Cotton Brown A	benzidine: 1-naphthylamine-4-sulphonic acid
618 (492)	Anthracene Acid Brown B	5-amino-2-hydroxybenzoic acid: 1.4-diaminonaphthalene-4-sulphonic acid
1.2.3.4-Tetraminobenzene		
221 (191)	Pyramine Yellow R	primuline
1.2.3.5-Tetraminobenzene-4.6-disulphonic Acid		
233 (210)	Cotton Orange R	primuline: 3-aminobenzene sulphonic acid
2.4.2'.4'-Tetraminodiphenylamine		
146 (141)	Indian Yellow G	1-aminobenzene-4-sulphonic acid
2.3.4.5-Tetraminotoluene		
561 (449)	Chlorazol Brown LF	benzidine: 1-naphthylamine-4-sulphonic acid: 2.7-diamino-8-naphthol-3.6-disulphonic acid: 5-amino-2-hydroxybenzoic acid
570 (454)	Trisulphone Brown G	*o*-tolidine: 1-naphthylamine-4-sulphonic acid: 2.7-diamino-8-naphthol-3.6-disulphonic acid: 5-amino-2-hydroxybenzoic acid
577 (457)	Trisulphone Brown 2G	dianisidine: 1-naphthylamine-4-sulphonic acid: 2.7-diamino-8-naphthol-3.6-disulphonic acid: 5-amino-2-hydroxybenzoic acid
***o*-Tolidine**		
382 (319)	Diamine Scarlet 3B	4-phenetidine: 1-amino-2-naphthol-6.8-disulphonic acid
407 (338)	Naphthamine Blue 3B	1.7-diamino-8-naphthol-4.6-disulphonic acid

	Dye	Other reduction products
o-**Tolidine**—*Continued.*		
430	Polar Red B	1-amino-2-naphthol-6.8-disulphonic acid: 4-aminophenol: toluene-4-sulphonic acid
46 (362)	Toluylene Orange R	2.4.5-triaminotoluene-6-sulphonic acid
447	Oxamine Violet R	2-amino-1-naphthol-4-sulphonic acid: 1.2.4-triaminobenzene (mono oxamic acid)
448 (363)	Benzopurpurine 4B (TC)	1.2-diaminonaphthalene-4-sulphonic acid
449 (364)	Benzopurpurine 6B	1.2-diaminonaphthalene-5-sulphonic acid
450 (365)	Benzopurpurine B	1.2-diaminonaphthalene-6-sulphonic acid
451 (366)	Diamine Red B	1.2-diaminonaphthalene-6-sulphonic acid: 1.2-diaminonaphthalene-7-sulphonic acid
452 (367)	Delta Purpurine 7B	1.2-diaminonaphthalene-7-sulphonic acid
453 (368)	Brilliant Purpurine 4B	1.2-diaminonaphthalene-4-and-6-sulphonic acid
454 (369)	Brilliant Purpurine R	1.2-diaminonaphthalene-3.6-disulphonic acid: 1.2-diaminonaphthalene-4-sulphonic acid
455	Brilliant Congo 2R	1.2-diaminonaphthalene-3.6-disulphonic acid: 1.2-diaminonaphthalene-7-sulphonic acid
456 (370)	Brilliant Congo R	1.2-diaminonaphthalene-3.6-disulphonic acid: 1.2-diaminonaphthalene-6-sulphonic acid
457 (371)	Rosazurine R	2-ethylamino-1-naphthylamine-7-sulphonic acid: 1.2-diamino-7-sulphonic acid
458 (372)	Rosazurine B	2-ethylamino-1-naphthylamine-7-sulphonic acid:
459 (373)	Congo Orange R	1.2-diaminonaphthalene-3.6-disulphonic acid: 4-phenetidine
459 (373)	Polar Orange R	1.2-diaminonaphthalene-3.6-disulphonic acid: 4-aminophenol: toluene-4-sulphonic acid
460 (374)	Congo Red 4R	1.2-diaminonaphthalene-4-sulphonic acid: 1-amino-2.4-dihydroxybenzene
461 (375)	Congo Corinth B	1.2-diaminonaphthalene-4-sulphonic acid: 2-amino-1-naphthol-4-sulphonic acid
462 (376)	Pyramidol Brown T	1-amino-2.4-dihydroxybenzene
463 (377)	Azo Blue	2-amino-1-naphthol-4-sulphonic acid
464 (378)	Direct Blue R (TC)	2-amino-1-naphthol-3. 6.8-trisulphonic acid: 1-amino-2-naphthol
465 (379)	Benzo New Blue 2B	2-amino-1-naphthol-4-sulphonic acid: 2-amino-1.8-dihydroxynaphthalene-3.6-disulphonic acid
466 (380)	Dianil Blue B	2-amino-1.8-dihydroxynaphthalene-3.6-disulphonic acid
467 (381)	Azo Black Blue B	1.7-diamino-8-naphthol-3.6-disulphonic acid: 4-amino-3-oxydiphenylamine
468 (382)	Azo Mauve B	1.7-diamino-8-naphthol-3.6-disulphonic acid: 1.4-diaminonaphthalene
469 (383)	Naphthazurine B	1.7-diamino-8-naphthol-3.6-disulphonic acid: 1.2-diaminonaphthalene
470 (384)	Chicago Blue 2R	1.7-diamino-8-naphthol-4-sulphonic acid: 1-amino-2-naphthol-8-sulphonic acid
471 (385)	Benzo Azurine 3R	2.6-diamino-5-naphthol-7-sulphonic acid: 2-amino-1-naphthol-4-sulphonic acid
472 (386)	Direct Blue BX (TC)	1.7-diamino-8-naphthol-3.6-disulphonic acid: 2-amino-1-naphthol-4-sulphonic acid
473 (387)	Columbia Blue G	1.7-diamino-8-naphthol-4-sulphonic acid: 2-amino-1-naphthol-3.8-disulphonic acid
474 (388)	Chicago Blue R	1.7-diamino-8-naphthol-4-sulphonic acid
475 (389)	Eboli Blue B	1.7-diamino-8-naphthol-3.5-disulphonic acid
476 (390)	Congo Cyanine B	1.7-diamino-8-naphthol-3.6-disulphonic acid: 1.7-diamino-8-naphthol-4-sulphonic acid
477 (391)	Direct Blue 3B (TC)	1.7-diamino-8-naphthol-3.6-disulphonic acid:
478 (392)	Toluylene Orange G	2.4.5-triaminotoluene-6-sulphonic acid: 5-amino-2-cresol-3-carboxylic acid
479 (393)	Diphenyl Brown 3GN	2-dimethylamino-7-amino-8-naphthol-6-sulphonic acid: 5-amino-2-hydroxybenzoic acid
480 (394)	Chrysamine R	5-amino-2-hydroxybenzoic acid
481 (395)	Chrysamine Yellow R	5-amino-2-cresol-3-carboxylic acid
482 (396)	Indazurine RM	8-amino-1.7-dihydroxy-2-carboxynaphthalene-4-sulphonic acid: 2-amino-1-naphthol-4-sulphonic acid

	Dye	Other reduction products
o*-Tolidine—*Continued.		
484 (397)	Direct Blue R	8-amino-1.7-dihydroxy-6-carboxynaphthalene-3-sulphonic acid: 2-amino-1-naphthol-4-sulphonic acid
485 (399)	Indazurine TS	8-amino-1.7-dihydroxy-2-carboxynaphthalene-4-sulphonic acid: 2.7-diamino-8-naphthol-6-sulphonic acid
486 (398)	Direct Grey B	8-amino-1.7-dihydroxy-6-carboxynaphthalene-3-sulphonic acid
562	Oxamine Black MT	2.7-diamino-8-naphthol-6-sulphonic acid: 1.2.4-triaminobenzene (mono oxamic acid)
563	Oxamine Violet MT	1-amino-2-naphthol-3.6-disulphonic acid: 1.2.4-triaminobenzene (mono oxamic acid)
564	Oxamine Violet BBR	2-amino-1-naphthol-4-disulphonic acid: 1.2.4-triaminobenzene (mono oxamic acid): 1-amino-2-naphthol
565	Oxamine Red MT	1-amino-2.4-dihydroxybenzene: 2.4.5-triaminotoluene (mono oxamic acid)
566 (450)	Benzo Black Blue R	1.4-diaminonaphthalene: 2-amino-1-naphthol-4-sulphonic acid
567 (451)	Congo Fast Blue R	1.4-diaminonaphthalene: 2-amino-1-naphthol-3.8-disulphonic acid
568 (452)	Benzo Indigo Blue	1.4-diaminonaphthalene: 7-amino-1.8-dihydroxynaphthalene-4-sulphonic acid
569 (453)	Columbia Black R	2.7-diamino-8-naphthol-3.6-disulphonic acid: 2.4.5-triaminotoluene
570 (454)	Trisulphone Brown G	2.7-diamino-8-naphthol-3.6-disulphonic acid: 2.3.4.5-tetraminobenzene: 1-naphthylamine-4-sulphonic acid: 5-amino-2-hydroxybenzoic acid
602 (481)	Azo Corinth	1-naphthylamine-4-sulphonic acid: 2.4-diamino-1.3-dihydroxybenzene: 3.4-diaminophenol-6-sulphonic acid
611	Hessian Brown MM	1-aminobenzene-4-sulphonic acid: 2.4-diamino-1.3-dihydroxybenzene
4-Toluene-sulphonic Acid		
377a	Polar Orange	Benzidine: 1.2-diaminonaphthalene-3.6-disulphonic acid: 4-aminophenol
430	Polar Red G	benzidine: 1-amino-2-naphthol-6.8-disulphonic acid: 4-aminophenol
430	Polar Red B	*o*-tolidine: 1-amino-2-naphthol-6.8-disulphonic acid: 4-aminophenol
459 (373)	Polar Orange R	*o*-tolidine: 1.2-diaminonaphthalene-3.6-disulphonic acid: 4-aminophenol
642	Polar Yellow 5G	4-aminophenol: 4-amino-1-(4-chloro-2-sulphobenzene)-3-methyl-5-pyrazolone
***o*-Tolidine-disulphonic Acid**		
487 (400)	Acid Anthracene Red 3B	1-amino-2-naphthol
***o*-Toluidine**		
17 (68)	Spirit Yellow R (TC)	2.5-diaminotoluene
60 (69)	Chrysoidine R	2.4.5-triamino-toluene
61	Oil Yellow OB (TC)	1.2-diaminonaphthalene
62	Cochineal Scarlet 2R	2-amino-1-naphthol-5-sulphonic acid
63 (70)	Crocein Orange R	1-amino-2-naphthol-6-sulphonic acid
64	Ponceau RT	1-amino-2-naphthol-3.6-disulphonic acid
65	Naphthamine Fast Scarlet	2-amino-1-naphthol-5.6-phenocarbazol-3-sulphonic acid
66 (71)	Azo Fuchsine B	*p*-toluidine: 7-amino-1.8-dioxynaphthalene-4-sulphonic acid
256 (230)	Cloth Red 3G	1.2-diaminonaphthalene-6-sulphonic acid: 2.5-diaminotoluene
257 (231)	Cloth Red 3BX	1-amino-2-ethylnaphthylamine-7-sulphonic acid: 2.5-diaminotoluene
258 (232)	Sudan IV (TC)	1-amino-2-naphthol: 2.5-diaminotoluene

	Dye	Other reduction products
***o*-Toluidine**—*Continued.*		
259 (233)	Cloth Red B (TC)	2-amino-1-naphthol-4-sulphonic acid: 2.5-diaminotoluene
260 (235)	Croceine 3B	2-amino-1-naphthol-4.8-disulphonic acid: 2.5-diaminotoluene
261 (234)	Cloth Red G	1-amino-2-naphthol-6-sulphonic acid: 2.5-diaminotoluene
262 (236)	Cloth Red 2B (TC)	1-amino-2-naphthol-3.6-disulphonic acid: 2.5-diaminotoluene
326 (279)	Benzo Fast Orange S	J-acid urea
638 (21)	Pigment Chrome Yellow L	4-amino-1-phenyl-3-methyl-5-pyrazolone
***p*-Toluidine**		
66 (71)	Azo Fuchsine B	7-amino-1.8-dioxynaphthalene-4-sulphonic acid: *o*-toluidine
2-Toluidine-5-sulphonic Acid		
18 (149)	Fast Yellow R	2.5-diaminotoluene-3-sulphonic acid
161 (151)	Orange T	1-amino-2-naphthol
283 (252)	Cloth Scarlet R	2.5-diaminotoluene: 1-amino-2-naphthol
284 (253)	Orseilline BB	2.5-diaminotoluene: 2-amino-1-naphthol-4-sulphonic acid
285 (254)	Bordeaux G	2.5-diaminotoluene: 1-amino-2-naphthol-6-sulphonic acid
286 (255)	Croceine Scarlet 8B	2.5-diaminotoluene: 1-amino-2-naphthol-8-sulphonic acid
641 (24)	Pigment Fast Yellow R	4-amino-phenyl-3-methyl-5-pyrazolone
4-Toluidine-2-sulphonic Acid		
162 (150)	Fast Yellow N	4-amino diphenylamine
634 (16)	Curcuphenine	dehydrothio-*p*-toluidine: 4.4-diamino-2.2-disulpho-stilbene
4-Toluidine-3-sulphonic Acid		
163 (152)	Permanent Red 4B	1.2-aminonaphthol-3-carboxylic acid
298	Fast Violet B	1.4-diaminonaphthalene: 1-amino-2-naphthol-6-sulphonic acid
639 (22)	Xylene Light Yellow 2G	4-amino-1-(2.5-dichlor-4-sulphobenzene)-3-methyl-5-pyrazolone
1.2.4-Triaminobenzene		
20 (33)	Chrysoidine Y (TC)	aniline
50 (59)	Wool Violet S	4-amino-diethylaniline-3-sulphonic acid
167 (154)	Acid Chrome Brown B (TC)	2-aminophenol-4-sulphonic acid
220 (190)	Benzo Brown 5R	primuline
273	Benzo Brown D3G	1.4-diaminobenzene: 1-aminobenzene-4-sulphonic acid
331 (283)	Bismarck Brown (TC)	1.3-diaminobenzene
333 (285)	Toluylene Brown G	2.6-diaminotoluene-4-sulphonic acid
339	Para Black R	1.4-diaminobenzene: 1.7-diamino-8-naphthol-4.6-disulphonic acid
352	Para Fast Brown GR	4.4-diamino-3.3-disulpho-diphenyl urea
352a	Para Fast Brown GK	3.3-diamino-diphenyl urea; 1.2.4-triaminobenzene-6-sulphonic acid
383	Oxamine Scarlet B	benzidine: 1.2-diaminonaphthalene-4-sulphonic acid
384	Oxamine Red B	benzidine: 2-amino-1-naphthol-4-sulphonic acid
396 (329)	Diamine Brown V	benzidine: 2.7-diamino-8-naphthol-6-sulphonic acid
447	Ozamine Violet R	*o*-tolidine: 2-amino-1-naphthol-4-sulphonic acid
494	Oxamine Black BR	dianisidine: 2-amino-1-naphthol-4-sulphonic acid
537	Titan Black J	1.4-diaminobenzene: 1.4-diaminonaphthalene-6-sulphonic acid: 2.6-diamino-5-naphthol-7-sulphonic acid
538	Oxydiamine Black N	2.7-diamino-8-naphthol-6-sulphonic acid: 1.4-diaminobenzene
540 (437)	Isodiphenyl Black R	1.4-diaminobenzene: 1-amino-2.4-dihydroxybenzene: 2.7-diamino-8-naphthol-6-sulphonic acid

	Dye	Other reduction products
1.2.4-Triaminobenzene—*Continued.*		
539 (436)	Direct Fast Black FF (TC)...	1.4-diaminobenzene: 1.4-diaminonaphthalene-6-sulphonic acid: 2.7-diamino-8-naphthol-6-sulphonic acid
546	Oxamine Violet GRF........	Benzidine: 1-amino-2-naphthol-3.6-disulphonic acid
547	Oxamine Black MB.........	benzidine: 2.7-diamino-8-naphthol-6-sulphonic acid
548	Oxamine Violet 2R..........	benzidine: 2-amino-1-naphthol-4-sulphonic acid
559 (448)	Diamine Bronze G..........	benzidine: 1.7-diamino-8-naphthol-3.6-disulphonic acid: 5-amino-2-hydroxybenzoic acid
560	Cotton Dark Brown T.......	benzidine: 5-amino-2-hydroxybenzoic acid: 2.7-diamino-8-naphthol-6-sulphonic acid
562	Oxamine Black MT.........	*o*-tolidine: 2.7-diamino-8-naphthol-6-sulphonic acid
563	Oxamine Violet MT..........	*o*-tolidine: 1-amino-2-naphthol-3.6-disulphonic acid
564	Oxamine Violet BBR........	*o*-tolidine: 2-amino-1-naphthol-4-sulphonic acid: 1-amino-2-naphthol.
570 (454)	Trisulphone Brown G........	*o*-tolidine: 2.7-diamino-8-naphthol-3.6-disulphonic acid: 5-amino-2-hydroxybenzoic acid
571	Oxamine Blue BB...........	Dianisidine: 1-amino-2-naphthol: 2-amino-1-naphthol-4-sulphonic acid
572	Oxamine Black MO.........	dianisidine: 2.7-diamino-8-naphthol-6-sulphonic acid
573	Oxamine Blue BT...........	dianisidine: 1-amino-2-naphthol-3.6-disulphonic acid
574	Oxamine Blue MD..........	dianisidine: 1-amino-2-naphthol-3.6-disulphonic acid
581 (462)	Direct Black EW (TC)......	benzidine: aniline: 1.2.7-triamino-8-naphthol-3.6-disulphonic acid
588 (469)	Chloramine Black N.........	benzidine: 2.5-dichloraniline: 1.2.7-triamino-8-naphthol-3.6-disulphonic acid
600 (479)	Dianil Black R...............	benzidine: 1-naphthylamine-4-sulphonic acid: 2.7-diamino-1.8-dihydroxynaphthalene-3.6-disulphonic acid
617 (491)	Dianil Black PR............	benzidine-3.3-disulphonic acid: 2.7-diamino-8-naphthol-6-sulphonic acid:
619	Naphthamine Fast Black RS	1.2.7-triamino-8-naphthol-3.6-disulphonic acid: 1.4-diaminobenzene
1.2.3-Triaminobenzene-4.6-disulphonic Acid		
222 (192)	Cotton Orange G...........	primuline
368 (306)	Pyramine Orange 3G........	benzidine: 1.2.4.5-tetraminobenzene
1.2.4-Triaminobenzene-5-sulphonic Acid		
98	Palatine Chrome Brown 2G ..	1.5-diamino-2-phenol
105 (88)	Acid Anthracene Brown R....	2.4.6-triamino-phenol (glycine der.)
352a	Para Fast Brown GK.........	1.2.4-triaminobenzene: 3.3-diaminodiphenylurea
1.2.4-Triaminobenzene-6-sulphonic Acid		
160	Hansa Rubine G............	1-amino-2-naphthol-3-carboxylic acid
3.4.4′-Triamino-diphenyl		
431 (355)	Anthracene Red I...........	5-amino-2-hydroxybenzoic acid: 2-amino-1-naphthol-4-sulphonic acid
432	Salicine Red B..............	5-amino-2-hydroxybenzoic acid: 1-amino-2-naphthol
433	Salicine Yellow G...........	5-amino-2-hydroxybenzoic acid
2.2′.4-Triaminodiphenylamine		
146 (141)	Indian Yellow G............	1-aminobenzene-4-sulphonic acid

	Dye	Other reduction products
2.4.4′-Triaminodiphenylamine		
146 (141)	Indian Yellow G...........	1-aminobenzene-4-sulphonic acid
147	Azo Flavine FF	1-aminobenzene-4-sulphonic acid
1.2.7-Triaminonaphthalene-3.6-disulphonic Acid		
398 (330)	Zambesi Brown G..........	Benzidine: 2.7-diamino-8-naphthol-6-sulphonic acid
1.2.7-Triamino-8-naphthol-3.5-disulphonic Acid		
243 (216)	Domingo Blue Black B......	aniline, 1.4-diaminobenzene
1.2.7-Triamino-8-naphthol-3.6-disulphonic Acid		
246 (217)	Acid Black 10B (TC)........	aniline: 1.4-diaminobenzene
247	Azo Dark Green A..........	aniline: diaminobenzene
581 (462)	Direct Black EW (TC)......	aniline: 1.2.4-triaminobenzene: benzidine
582 (463)	Direct Black RX (TC).......	aniline: 2.4.5-triaminotoluene: benzidine
583 (464)	Direct Green ET (TC).......	aniline: 4-aminophenol: benzidine
585 (466)	Eboli Green CW............	aniline: 1-aminobenzene-4-sulphonic acid: benzidine: 5-amino-2-hydroxybenzoic acid
586 (467)	Diphenyl Green G..........	1.4-diamino-2-chlorbenzene: benzidine: 4-aminophenol
587 (408)	Diphenyl Green 3G..........	1.4-diamino-2-chlorbenzene: benzidine: 5-amino-2-hydroxybenzoic acid
588 (469)	Chloramine Black N.........	2.5-dichloraniline: benzidine: 1.2.4-triaminobenzene
589 (470)	Chloramine Green B (TC)....	2.5-dichloraniline: benzidine: 4-aminophenol
590 (471)	Chloramine Blue 3G	2.5-dichloraniline: benzidine: 1.7-diamino-8-naphthol-3.6-disulphonic acid
591 (472)	Chloramine Blue HW........	2.5-dichloraniline: benzidine: 2.7-diamino-8-naphthol-6-sulphonic acid
592 (473)	Naphthamine Black H.......	1.4-diaminobenzene: benzidine
593 (474)	Direct Green B (TC)........	1.4-diaminobenzene: 4-aminophenol: benzidine
594 (475)	Direct Green G (TC)........	1.4-diaminobenzene: 5-amino-2-hydroxybenzoic acid: benzidine
619	Naphthamine Fast Black RS.	1.4-diaminobenzene: 1.2.4-triaminobenzene
1.2.7-Triamino-8-naphthol-4.6-disulphonic Acid		
244 (215)	Blue Black N..............	aniline: 1.4-diaminobenzene
245 (219)	Chrome Patent Green C.....	aniline: 1.3.5-triamino-2-phenol
531	Chrome Patent Green A.....	aniline: 1.4-diaminonaphthalene: 5-amino-2-hydroxybenzoic acid
1.2.7-Triamino-8-naphthol-4-sulphonic Acid		
241 (220)	Wool Black 4B............	1-naphthylamine: 1-aminobenzene-4-sulphonic acid
595	Diazo Olive G.............	benzidine: 1.4-diaminobenzene: 5-amino-2-hydroxybenzoic acid
599 (478)	Direct Green CO...........	benzidine: 1-aminobenzene-4-sulphonic acid: 5-amino-2-hydroxybenzoic acid
1.3.5-Triamino-2-phenol		
7 (5)	Picric Acid	
101 (89)	Metachrome Brown B.......	2.4.5-triamino-toluene
102	Chrome Olive..............	1.2-diamino-naphthalene
103	Metachrome Brown Y.......	4-amino-2-cresol
104	Metachrome Olive Brown G..	3-amino-4-cresol
105	Acid Anthracene Brown R....	1.2.4-triaminobenzene-5-sulphonic acid (glycine)
106 (90)	Chrome Brown P...........	2.5-diamino-phenol
107 (92)	Metachrome Bordeaux R.....	2.4.5-triaminotoluene-*p*-toluene sulphonamide
108 (91)	Anthracyl Chrome Green A...	1.2-diaminonaphthalene-4-sulphonic acid
245 (219)	Chrome Patent Green C	aniline: 1.2.7-triamino-8-naphthol-4.6-disulphonic acid
272	Granite Black..............	1-amino-2-naphthol: 1.4-diaminonaphthalene-6 or 7-sulphonic acid
2.4.5-Triamino-toluene		
21 (34)	Chrysoidine R (TC).........	aniline
60 (69)	Chrysoidine R.............	*o*-toluidine
101 (89)	Metachrome Brown B.......	1.3.5-triamino-2-phenol
332 (284)	Bismarck Brown 2R (TC)....	2.4-diaminotoluene

	Dye	Other reduction products
2.4.5-Triamino-toluene—*Continued.*		
345 (295)	Diphenyl Fast Black.........	4.4-diamino-3.3′-ditolyl amine: 2.7-diamino-8-naphthol-6-sulphonic acid
379	Oxamine Orange G..........	benzidine: 4-aminophenol
506 (413)	Direct Violet BB............	dianisidine: 8-amino-1.7-dihydroxynaphthalene-4-sulphonic acid
539 (436)	Direct Fast Black FB (TC)...	1.4-diaminobenzene: 1.4-diaminonaphthalene-6-sulphonic acid: 2.7-diamino-8-naphthol-6-sulphonic acid
565	Oxamine Red MT...........	*o*-tolidine: 1-amino-2.4-dihydroxybenzene
569 (453)	Columbia Black R...........	*o*-tolidine: 2.7-diamino-8-naphthol-3.6-disulphonic acid
575 (455)	Columbia Black B...........	dianisidine: 2.7-diamino-8-naphthol-3.6-disulphonic acid
577 (457)	Trisulphone Brown 2G.......	dianisidine: 2.7-diamino-8-naphthol-3.6-disulphonic acid: 5-amino-2-hydroxybenzoic acid
582 (463)	Direct Black RX (TC).......	benzidine: aniline: 1.2.7-triamino-8-naphthol-3.6-disulphonic acid
2.4.5-Triaminotoluene-*p*-toluene sulphon amide		
107 (92)	Metachrome Bordeaux R.....	1.3.5-triamino-2-phenol
2.4.5-Triaminotoluene-6-sulphonic Acid		
446 (362)	Toluylene Orange R.........	*o*-tolidine
478 (392)	Toluylene Orange G.........	*o*-tolidine: 5-amino-2-cresol-3-carboxylic acid
Xylidines (Mxt.)		
73 (76)	Sudan II...................	1-amino-2-naphthol
74 (77)	Azo Cocein 2R..............	2-amino-1-naphthol-4-sulphonic acid
75 (78)	Cochineal Scarlet 4R........	2-amino-1-naphthol-5-sulphonic acid
76 (80)	Wool Scarlet R.............	2-amino-1-naphthol-4.8-disulphonic acid
78 (79)	Brilliant Orange R..........	1-amino-2-naphthol-6-sulphonic acid
***m*-Xylidine**		
77 (81)	Palatine Scarlet.......	2-amino-1-naphthol-3.6-disulphonic acid
79 (82)	Ponceau 2R................	1-amino-2-naphthol-3.6-disulphonic acid
234 (211)	Resorcine Brown B (TC).....	2.4-diamino-1.3-dihydroxybenzene: 1-aminobenzene-4-sulphonic acid
263 (237)	Bordeaux BX.........	1-amino-2-naphthol-6-sulphonic acid
264 (238)	Union Fast Claret...........	1-amino-2-naphthol-3.6-disulphonic acid
***m*-4-Xylidine-5-sulphonic Acid**		
240 (214)	Fast Brown O..............	2.4-diamino-1-naphthol
287	Bordeaux BX...............	1-amino-2-naphthol
644	Normal Yellow 3GL	4-amino-1-(sulphobenzene)-5-pyrazolone-3-carboxylic acid

THE PHYSICAL AND CHEMICAL PROPERTIES OF THE REDUCTION PRODUCTS FROM AZO DYES

The physical and chemical properties of the products which are formed by the reduction of azo dyes are of service in identifying them. Data could not be found in the literature for a great many of these products; however, all available data have been collected and placed under the names of the respective products to which they belong.

The compounds listed are formed by the complete reduction of azo colouring matters.

Amino Acetoacetic Ester

$$\begin{array}{l} CO.CH_3 \\ | \\ CH.NH_2 \\ | \\ CO.OC_2H_5 \end{array}$$

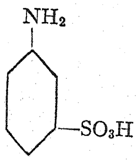
$C_6H_{11}NO_3$; Mol. Wt. 145.13; (C, 49.6% H, 7.6%; N, 9.7%; O, 33.1%).

The free base soon changes in air to a coloured subst. of the type of purpuric acid which decomp. above 250° without melting.

Hydrochloride, needles (ether-alc.), M. P. 95° (with turbulent decomp.), hygroscopic and very sol. in H_2O and alc., insol. in ether. Very reactive, reducing Fehling's sol. in cold. With alkalies yields dimethylpyrazinedicarboxylic acid, M. P. 86°; with phenylhydrazine yields phenylmethylpyrazonazobenzene, orange-red needles, M. P. 155°.

Picrate, fine needles, M. P. 129° (turning brown).

1-Aminobenzene-3-sulphonic Acid (Metanilic Acid)



$C_6H_7NO_3S$; Mol. Wt. 173.15; (C, 41.6%; H, 4.1%; N, 8.1%; O.,27.7%; S, 18.5%).

Long colourless needles or prisms (1½ H_2O)

Hydrochloride, needles, M. P. 235° (decomposition), readily soluble in H_2O and alcohol. Metallic salts are readily soluble. The Ba salt gives no precipitate with bromine water (distinction from *o*- and *p*-isomers).

Acetyl deriv.: the free acid is not acetylated.

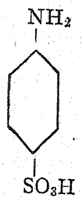
Na acet-metanilate ($2H_2O$), long colourless needles, loses H_2O at 100° and melts at 184–5°; Ba acet-metanilate ($2H_2O$), glittering colourless needles, decomposes over 300°.

Sulphonamide, glistening leaflets or long needles, M. P. 142°, difficultly soluble in cold H_2O, readily in hot; acetyl sulphonamide, small rhombs (Ac HO), M. P. 216–9°, soluble in acetone or hot Ac HO; chloracetyl sulphonamide, needles (alcohol), melts incompletely at 153–5° and gives clear melt at 165°.

Gives *m*-diazobenzene sulphonic acid with nitrous acid.

Iodo derivatives, see *J. Chem. Soc.*, **95**, 1683.

1-Aminobenzene-4-sulphonic Acid (Sulphanilic Acid)



$C_6H_7NO_3S$; Mol. Wt. 173.15; (C, 41.6%; H, 4.1%; N, 8.1%; O, 27.7%; S, 18.5%).

Rhombic plates. Dihydrate below 21° (efflorescent), monohydrate 21°–40°, anhydrous over 40°. Soluble in 224 parts H_2O at 0°, 90 parts at 18.9° and 34 parts at 54.5°.

The hydrochloride and metallic salts are readily soluble. The Ba salt gives a precipitate of tribromaniline, M. P. 119°, with bromine water (distinction from metanilic acid).

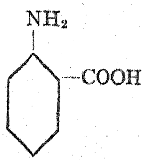
Acetyl-sulphanilic acid—Chloride, small needles (C_6H_6), M. P. 149°, soluble in alcohol, ether and Ac HO, insoluble in H_2O; -ethyl ester, white needles (C_6H_6), M. P. 115°;-*p*-phenetidine, white glistening leaflets, M. P. 204°. Benzoylsulphanilic acid chloride, yellow needles (C_6H_6), M. P. 176°. Benzolsulphon-sulphanilic acid, M. P. 178°, readily soluble in H_2O; -chloride, white needles (Ac HO), M. P. 177°.

Gives *p*-diazobenzene sulphonic acid with nitrous acid.

Gives quinone with chromic acid mixture (distinction from metanilic acid).

With ferricyanide it gives a flesh-red ozoxy dye, easily soluble in warm water, with a yellow colour.

2-Amino Benzoic Acid (Anthranilic Acid)



$C_7H_7NO_2$; Mol. Wt. 137.1; (C, 61.3%; H, 5.1%; N, 10.2%; O, 23.3%).

Leaflets with characteristic sweet taste, melting at 144–5°. 0.519 part soluble in 100 cc. H_2O at 25°, 10.7 parts in alcohol at 9° and 16 parts in ether at 7°. Sublimes *in vacuo*, is slightly volatile with steam and is decomposed by boiling H_2O, yielding aniline. Sols. fluoresce blue.

Hydrochloride: needles, M. P. 191°; sulphate ($+2H_2O$), needles, M. P. 188°.

Acetyl deriv.: long, flat rhombic needles (Ac HO), M. P. 185°; diacety, deriv., colourless cryst., M. P. 220°; benzoyl deriv.: long needles (alc.)l M. P. 181°.

With sym. trinitrobenzene it forms an additive product, orange-red needles, M. P. 192–3° (cor.), and its K salt a corresponding product, deep-red needles, M. P. 114° (cor.) (Sudborough & Beard). The former comp. gives orange-yellow needles, M. P. 186–7° by (Ostomisslenski).

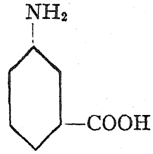
Condensation products.—With chloracetone (and K_2CO_3) acetonyl-anthranilic acid, M. P. 169–70°; with sulfuryl chloride, 2-amino-3, 5-dichlor-benzoic acid, M. P. 223° (acetyl deriv., M. P. 278°); with chloroacetic acid, phenylglycine carboxylic acid; with phenacyl bromide, the phenacyl ester, M. P. 181–2°; with benzene sulphochloride, N-phenylsulphon-anthranilic acid, M. P. 214–5°; with *o*-nitrobenzaldehyde, brick-red, M. P. 167–8° (with *m*-isomer, yellow, M. P. 198–200°; with *p*-isomer, colourless, M. P. 165–7°); with sym. trinitrobenzaldehyde, 2, 4, 6-trinitrobenzal-*o*-amino-benzoic acid, M. P. 146°; with 1, 3, 4, 6-bromtrinitrobenzene, 5-brom-2, 4-dinitrodiphenylamine-2′-carboxylic acid, garnet-red prisms, M. P. 274–6°; with γ-trinitrotoluene, the 5-methyl isomer of the last, red-yellow cryst., M. P. 244–5°.

Diazotised and coupled with—β-naphthol, red cryst. (Ac HO), M. P. 276°, wine-red sol. in H_2SO_4, orange-red precipitate, on dil.; with Naphthol AS, orange-red cryst. (Ac HO), M. P. 310°, wine-red sol. in H_2SO_4, yellow-red precipitate on dil.

Heated with HNO_3 anthranilic acid yields picric acid; with HNO_2 it gives salicylic acid ($FeCl_3$ test).

(For further differentiation see *Ber.* **44**, 3306.)

3-Amino-benzoic Acid



$C_7H_7NO_2$; Mol. Wt. 137.1; (C, 61.3%; H, 5.1%; N, 10.2%; O, 23.3%).

Reddish cryst. warts with sweet taste melting at 174°; D. 1.5104 at 4°; 0.67 part sol. in 100 cc. H_2O at 20°; 1.81 in ether at 6°; 2.92 in alcohol at 12°. Sublimes, in part undecomposed. Is stable in boiling H_2O and is not volatile with steam.

Hydrochloride, mod. sol. in H_2O and alcohol, sl. sol. in HCl. (prisms).

Sulphate ($+H_2O$), needles, sl. sol. in cold H_2O, M. P. 225° (anhyd., 230°).

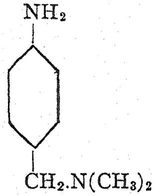
Ba salt ($+4H_2O$), difficultly soluble in H_2O.

Acetyl deriv.: micro needles, M. P. 248° with evolution of gas (sublimes).

Condensation product.—With *o*-nitrobenzaldehyde, colourless, M. P. 220–2°; with *m*-nitrobenzaldehyde, white, M. P. 260–2°; with *p*-nitrobenzaldehyde, yellow, M. P. 246–7°; with γ-trinitrotoluene, 2-4-dinitro-5-methyl-diphenylamine-3′-carboxylic acid, yellow prisms, M. P. 247–8°; with 1, 3, 4, 6-bromtrinitrobenzene, the 5-brom isomer of the foregoing, red-yellow needles, M. P. 245°. With *p*-nitrobenzyl chloride it gives a yellow ester, M. P. 198°.

(For further differentiation see *Ber.*, **44**, 3306.)

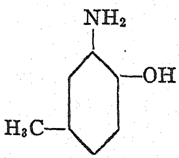
4-Aminobenzyl-dimethylamine



$C_9H_{14}N_2$; Mol. Wt. 150.17; (C, 71.9%; N, 9.4%; N, 18.7%).

Viscous colourless oil, with strong basic odour, which boils somewhat above 300° with slight decomp. The salts are very soluble in H_2O. The sulphate is obtained in slightly-yellow, glittering leaflets by adding conc. H_2SO_4 to an alcohol solution of the base. After diazotisation it may be coupled with β-naphthol, giving a yellow-red basic azo dye which cryst from dil. alcohol in red needles, M. P. 120°.

3-Amino-4-cresol



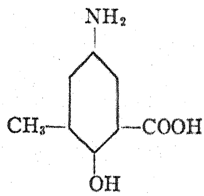
C_7H_9NO; Mol. Wt. 123.12; (C, 68.3% H, 7.4%; N, 11.4%; O, 13.0%).

Scales (rhomb cryst. from ether), M. P. 135°. Sublimes easily in leaflets or needles. Very sl. sol. in H_2O, but soluble in acids or alkalies. Readily soluble in alcohol, ether, or $CHCl_3$, much less so in C_6H_6.

The aqueous solution of the hydrochloride (but not of the free base) is coloured red by $FeCl_3$.

N-acetyl deriv., long needles (H_2O), M. P. 159–60°, very sl. sol. in cold H_2O, alcohol, ether and C_6H_6; diacetyl deriv., large foliated cryst. or flat needles, M. P. 145°; benzoyl deriv., shining, mother-of-pearl leaflets (alcohol), M. P. 191°; *o*-acetyl-N-benzoyl deriv., M. P. 134 deg.; *o*-benzoyl-N-acetyl deriv., M. P. 146°.

5-Amino-2-cresol-3-carboxylic Acid

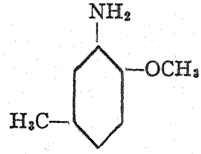


$C_8H_9NO_3$; Mol. Wt. 167.12; (C, 57.5%; H, 5.4%; N, 8.4%; O, 28.7%).

Small leaflets. The melting point is given as 267° (decomp.) by Puxeddo and Maccioni and as over 300° (decomp.) by Nietski and Ruppert. It is very difficultly soluble in H_2O and alcohol.

By distillation with KOH it yields 5-amino-*o*-cresol, small leaflets, M. P. 172–3° (174–5° after resublimation). The acetyl deriv. of the latter cryst. in small needles, melting at 275°, and with fuming HNO_3 gives 3-nitro-5-acetylamino-*o*-cresol, thick yellow needles (alcohol), M. P. 217°.

3-Amino-4-cresol-methyl Ether (*p*-cresidine)



$C_8H_{11}NO$; Mol. Wt. 137.14; (C, 70.0% H, 8.1%; N, 10.2%; O, 11.7%).

White cryst. (H_2O), M. P. 51.5°, B. P. 235°. Readily soluble in alcohol, ether and C_6H_6, more difficultly soluble in hot H_2O. Volatile with steam.

Hydrochloride (+H_2O), long rhomb. prisms, readily soluble in H_2O. A mixture of the hydrochloride and free base in an alcohol solution of $NaNO_2$ forms aminoazo-*p*-cresol methyl ether, M. P. 156°.

Formyl deriv.: prisms (alcohol), M. P. 86°; acetyl deriv., leaves, M. P. 110°.

The condensation product with α-halogen derivs. of β-naphthol melts at 118°.

Heated with acetoacetic ester it gives a product which melts at 80°.

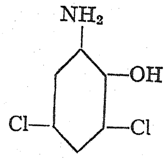
Diazotised and coupled with: β-naphthol, dark, red, prism. needles (toluene) with green lustre, M. P. 174°, deep purple sol. in H_2SO_4, orange-red precipitate on dil.; Naphthol AS, dark red needles (toluene), M. P. 223°, indigo-blue soluble in H_2SO_4, red precipitate on dilution.

3-Amino-4-cresol-5 or 6-sulphonic Acid

$C_7H_9NO_4S$; Mol. Wt. 203.18; (C, 41.4%; H, 4.5%; N, 6.9%; O, 31.5%; S, 15.8%).

The reduction product would probably be 3-amino-4-cresol-5-sulphonic acid or 3-amino-4-cresol-6-sulphonic acid. Both give yellow diazo compounds, that of the latter being less soluble in H_2O. They could probably be distinguished by conversion into characteristic pyrazolon dyes. (See Conn, "Die Pyrazolfarbstoffe.")

2-Amino-4. 6-dichlor Phenol



$C_6H_5Cl_2NO$; Mol. Wt. 178.0; (C, 40.5%; H, 2.8%; Cl 39.8%; N, 7.9%; O, 9.0%).

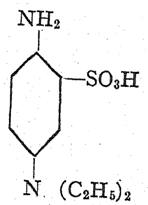
White scales, unstable. Forms no alkaline salts.

Hydrochloride, readily soluble in H_2O and alcohol, precipitated by HCl. Gives AgCl and silver mirror with $AgNO_3$. Sublimes at 120° in white lustrous cryst. leaflets.

Sulphate, cryst. from aqueous solution with addition of excess H_2SO_4. Colour is light gray (as is that of the hydrochloride).

Diazotised and coupled with acetoacetic ester it gives 1–3[1], 5[1]-dichlor-2[1]-oxyphenyl-3-methyl-5-pyrazolon, insoluble in H_2O, NaOAc and acids, soluble in hot alcohol and dil. alkalies.

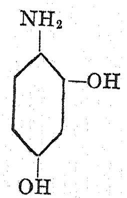
4-Amino-diethyl-aniline-3-sulphonic Acid



$C_{10}H_{16}N_2O_3S$; Mol. Wt. 244.25; (C, 49.1%; H, 6.6%; N, 11.5%; O, 19.7%; S, 13.1%).

Crystals, soluble in alcohol and very soluble in H_2O. It yields an insoluble cryst. benzylidene comp. in alk. solutions with salicylic aldehyde.

1-Amino-2.4-dihydroxy-benzene (**4-Amino-resorcin**)



$C_6H_7NO_2$; Mol. Wt. 125.09; (C, 57.6%; H, 5.6%; N, 11.2%; O, 25.6%).

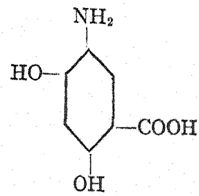
The free base is unstable.

Hydrochloride ($+2H_2O$), glittering colourless prisms. Is a strong reducing agent. If the aqueous solution is made slightly alkaline it is coloured by the air, first blue, then green and finally yellow-brown. It is coloured garnet-red by HNO_3. A strong solution of $FeCl_3$ gives a deep brown colour and then an almost black precipitate.

Tribenzoyl deriv., white, silky needles, M. P. 172°, readily soluble in benzene, alcohol, HOAc and $CHCl_3$, but only sl. sol. in ligroin. It dissolves in H_2SO_4, with a blue-violet colour.

Tetraacetyl deriv., M. P. 106–8°, readily soluble in cold benzene, ether, HOAc and $CHCl_3$. It dissolves in H_2SO_4, with a violet colour.

3-Amino-4.6-dihydroxy-benzoic Acid (Amino-beta-resorcylic Acid)



$C_7H_7NO_4$; Mol. Wt. 169.1; (C, 49.7%; H, 4.2%; N, 8.3%; O, 37.8%).

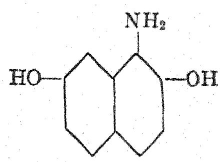
Prisms, M. P. 193°, difficultly soluble in AcHO and hot H_2O, readily soluble in KOH and HNO_3 solutions.

The hydrochloride is more soluble than the free acid.

Blue-green cryst., M. P. 212–3°.

Sulphate, white needles, M. P. 226°, readily decomposed by H_2O.

1-Amino-2, 7-dihydroxynaphthalene



$C_{10}H_9NO_2$; Mol. Wt. 175.13; (C, 68.5%; H, 5.2%; N, 8.0%; O, 18.3%).

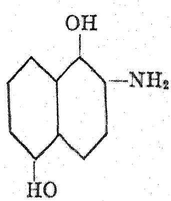
The free base is unstable, oxidising in the air quickly. The oxidation product is 1, 2, 7-oxynaphthoquinone, small brown needles, M. P. 194°.

The hydrochloride, needles or leaflets, is more stable.

Triacetyl deriv., M. P. 183°; tetracetyl deriv., M. P. 135°.

Heated with aniline and iodine it gives 2, 7-diphenylamino-1-naphthylamine, M. P. 164°.

2-Amino-1, 5-dihydroxynaphthalene

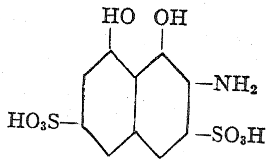


$C_{10}H_9NO_2$; Mol. Wt. 175.13; (C, 68.5%; H, 5.2%; N, 8.0%; O, 18.3%).

The free base is unstable, particularly in the moist condition, and becomes coloured quickly in the light and partially resinous.

The hydrochloride is readily soluble in H_2O but is difficultly soluble in 20% HCl, from which it cryst. in gray-white needles or prisms. It gives a $ZnCl_2$ double salt, colourless needles, difficultly soluble. Treated with $FeCl_3$ a solution of the hydrochloride gives a red-violet colour, turning brown; and, with further $FeCl_3$, a deep red-brown solution from which red needles are deposited at once.

2-Amino-1.8-dihydroxynaphthalene-3.6-disulphonic Acid (Amino-chromotropic Acid)



$C_{10}H_9NO_8S_2$; Mol. Wt. 335.25; (C, 35.8%; H, 2.7%; N, 4.2%; O, 38.2%; S, 19.1%).

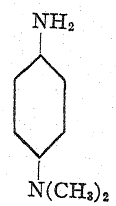
Colourless amorph. substance, readily soluble in H_2O. It dyes wool bistre-brown with subsequent chroming. An ammonium solution on filter paper turns orange in air and gives a yellow spot with HCl which fades on drying. Excess $FeCl_3$ gives a brown-red colour. The solution in AcNaO is scarcely oxidised by the air.

Acid Ba salt ($2H_2O$), small yellow needles.

Ba salt ($3H_2O$), yellow-red needles, difficultly soluble in H_2O.

Na salt, small red cryst. which turn brown-red on air drying. On oxidation with HNO_3 it gives 8-hydroxyl-1-, 2-naphthoquinone-3, 6-disulphonate, gold yellow prisms, readily soluble in H_2O but insoluble in alcohol or AcHO, coloured intense blue-red by trace of alk. and yellow again with excess alk. With *o*-toluylene diamine it gives toluoxynaphthazine disulphonate, soluble in H_2O, with a yellow colour turned gradually cherry-red by HCl, and soluble in conc. H_2SO_4 with a blue-violet colour.

4-Aminodimethylaniline



$C_8H_{12}N_2$; Mol. Wt. 135.14; (C, 71.1%; H, 8.2%; N, 20.7%).

Long needles, M. P. 41°, B. P. 262.3° (cor.). D = 1.0357 at 25°. Easily soluble in cold H_2O and org. solv.; volatile with difficulty with steam

Hydrochloride, deliquescent leaflets.

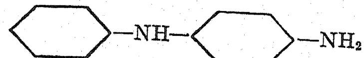
Acetyl deriv., slender, white needles (H_2O), M. P. 132.3°.

Decomposes into methyl chloride and *p*-phenylenediamine in stream of HCl at 180°.

Oxidised with dichromate in presence of thiosulphate it gives Bindschedler's green and, finally, methylene blue. It also gives the latter dye when oxidised with $FeCl_3$ in presence of H_2S. Oxidised with dichromate with the *m*-isomer it gives a violet-red dye.

If a solution is boiled and passed through a filter impregnated with $Hg_2(NO_3)_2$ the filter is coloured green on cooling.

4-Aminodiphenylamine



$C_{12}H_{12}N_2$; Mol. Wt. 184.17; (C, 78.2%; H, 6.6%; N, 15.2%).

Flat prisms from ligroin or gasoline which melt at 75°, or silky needles from alc. which melt at 66°, but after fusion and resolidification then melt at 75°. Under one atmosphere of hydrogen it boils at 354°. Slightly soluble in H_2O, readily soluble in abs. alc. or ether.

Solutions of the salts give a red colour with dil. $FeCl_3$, soon turning green, and, at greater conc., a green precipitate, which dissolves in H_2SO_4, with a carmine-red colour.

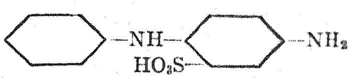
The sulphate cryst. in fine glittering white sp. sol. leaflets and gives a diazo salt with HNO_2, leaflets, very difficultly soluble in H_2O.

The free base gives an insoluble monochlorimide with alk. hypochlorite, and an addition product with sym. trinitrobenzene, black plates, M. P. 105.5°.

Acetyl deriv., ruby-red needles, M. P. 238°.

On oxidation in acid aqueous solution with H_2O_2 and a trace of $FeSO_4$ it yields a voluminous indigo-blue precipitate. (Willstätter's imide.)

4-Aminodiphenylamine-2-sulphonic Acid



$C_{12}H_{12}N_2O_3$; Mol. Wt. 264.23; (C, 54.5%; H, 4.6%; N, 10.6%; O, 18.2%; S, 12.1%).

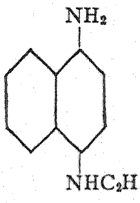
Dark leaflets which dissolve in H_2O readily, yielding unstable solutions which soon darken in air.

With $FeCl_3$ the solutions turn red and then violet and yield a dark precipitate. Bleaching powder in acid (HCl) solution gives a blue colour which gradually turns green and then violet.

Ba salt ($+H_2O$), silvery gray leaflets which darken on exposure to air.

Anilide, glittering leaflets (alc.), M. P. 171°.

4-Amino-1-ethylnaphthylamine

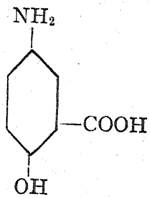


$C_{12}H_{14}N_2$; Mol. Wt. 186.17; (C, 77.4%; H. 7.6%: N 15.0%).

According to Koch the base is a yellowish product which turns dirty green and then black on drying. The hydrochloride cryst. in rose coloured leaflets which melt at 152°. The picrate cryst. in small red-brown needles, M. P. 180°, difficultly soluble in H_2O and alc. The base yields α-naphthoquinone, M. P. 125°, on oxidation with chromic acid.

According to Bamberger the base is an oil, slightly soluble in H_2O and readily soluble in organic solvents. Its solutions are darkened quickly by light and air. It gives a weak brown colour with $FeCl_3$. With dichromate and *m*-tolylenediamine it gives a blue-green colour which turns red on heating. The hydrochloride is described as a silvery white cryst. powder which turns greenish in air, readily soluble in H_2O and difficultly soluble in HCl. Its melting point is given as 193°.

5-Amino-2-hydroxybenzoic Acid (Amino-salicylic Acid)



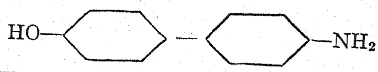
$C_7H_7NO_3$; Mol. Wt. 153.1; (C, 54.9%; H, 4.6%; N, 9.1%; O, 31.4%).

Glittering needles, sparingly soluble in H_2O (sol. in dil. alkalies). Turns brown in air. At about 280° it decomposes with evolution of CO_2 and formation of *p*-aminophenol (the latter gives benzoquinone on acid oxidation). The free base gives a blood-red colour with $FeCl_3$ in ether or benzene. Does not yield nitrogen when heated with nitrous acid.

Hydrochloride, long colourless needles, only sparingly soluble with excess HCl; Sulphate, prisms, M. P. 334°.

Acetyl deriv., massive colourless cryst. (½H_2O), M. P. 218°, soluble in H_2O, alc. and Ac HO; benzoyl deriv., amorphous powder ($CHCl_3$), M. P. 252°, only slightly soluble in hot H_2O.

4-Amino-4′-hydroxydiphenyl



$C_{12}H_{11}NO$; Mol. Wt. 185.16; (C, 77.8%; H, 6.0%; N, 7.6%; O, 8.6%).

Colourless glittering needles (anisole) or six-sided leaflets (alc.). M. P. 217.5°. Nearly insoluble in H_2O and only slowly soluble in hot organic solvents.

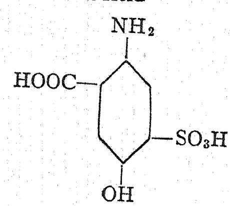
The hydrochloride is sparingly soluble and the sulphate nearly insoluble. Both cryst. in white sparkling leaflets. The base dissolved in HCl is coloured intense yellow by nitrite. A weakly acid solution of the hydrochloride gives a green-brown colour with $FeCl_3$, turning gray-violet on heating and depositing dark flocks.

It gives a diazonium chloride which cryst. with $2H_2O$ in red silky needles and loses its H_2O over H_2SO_4, turning yellow.

It may be converted into 4, 4′-diphenol, M. P. 274–5°.

The acetamino deriv., leaflets or prisms, M. P. 225°, is readily soluble in alcohol or in alkalies and nearly insoluble in H_2O.

5-Amino-2-hydroxy-3-sulphobenzoic Acid

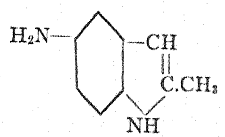


$C_7H_7NO_6S$; Mol. Wt. 233.16; (C, 36.0%; H, 3.0%; N, 6.1%; O, 48.0%; S, 13.8%).

Gray powder, only moderately soluble in H_2O, but readily soluble in presence of alkalies. It gives a red-brown colour with chromic acid. The diazo compound is difficultly soluble.

(Neither the formula nor the description of properties is certain. There are three possible isomeric sulpho acids, and no thoroughly reliable data are available concerning them.)

Amino-alpha-methyl Ketol

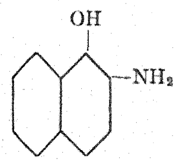


$C_9H_{10}N_2$; Mol. Wt. 146.14; (C, 73.9%; H, 6.9%; N, 19.2%).

White, light powder, M. P. 137°.

Acetyl deriv., white amorphous powder, M. P. 188°. Both the amine and its acetyl deriv. are difficultly soluble in H_2O, but easily soluble in alcohol, ether, $CHCl_3$, benzol or xylol, from which they may be precipitated in white flocks by petroleum spirit.

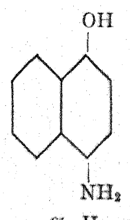
2-Amino-1-naphthol



$C_{10}H_9NO$; Mol. Wt. 159.13; (C, 75.4%; H, 5.7%; N, 8.8%; O, 10.1%).

Difficultly soluble in cold H_2O. Cryst. in needles from H_2O containing SO_2. Shaken with air its ammoniacal solution is coloured green and a violet skin of iminooxynaphthalene with a glittering metallic lustre separates on the surface. With oxidising agents 2-amino-1-naphthol gives dinaphthyl-2-diquinone but no naphthoquinone.

4-Amino-1-naphthol



$C_{10}H_9NO$; Mol. Wt. 159–13; (C, 75.4%; H, 5.7%; N, 8.8%; o, 10.1%).

The hydrochloride, needles, is readily soluble in H_2O and gives a cryst. double salt with $SnCl_2$. With HNO_2, or by heating with $FeCl_3$ or with oxidising agents in general it gives alphanaphthoquinone. With $CaCl_2$ and dil. HCl at 0° it gives 1, 4-naphthoquinone chloramide.

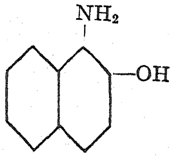
The picrate precipitates as a yellow crystalline powder.

The N-acetyl deriv. cryst. in needles (alc.) M. P. 187°. It gives a nitrosamine which melts at 203° and dissolves in alkalies with a gold-yellow colour. Boiled with chloroacetic acid and NaOH it gives 4-acetamino-1-naphthoxyacetic acid, colourless aggregates of spears which soften at about 225° and melt at 233–4°.

The diacetyl deriv. ($C_2H_3O.NH.C_{10}H_6.O.C_2H_3O$), prismatic cryst. ($H_2O$), M. P. 158°, may be sublimed.

Heated with aniline (180°) the base gives 1-anilino-4-hydroxynaphthalene, colourless cryst., M. P. 92°. Corresponding deriv. with *p*-chloraniline, M. P. 96°; with 2, 4-dichloraniline, colourless needles, M. P. 73°; with anthranilic acid, M. P. 247-9°.

1-Amino-2-naphthol



$C_{10}H_9NO$; Mol. Wt. 159.13; (C, 75.4%; H, 5.7%; N, 8.8%; O, 10.1%).

The free aminophenol cryst. in glittering leaflets which are very difficultly soluble in hot H_2O. Cryst. in quadratic plates from ether (fluorescent sol.). It gives a yellow solution in ammonia which turns dark brown on shaking with air.

The hydrochloride, fine white needles, is easily soluble in H_2O. The addition of sodium acetate to the solution precipitates the base; the addition of alkalies results in no precipitation, but the solution turns brown. Sol. in 15 parts boiling alc. and only slightly soluble in dil. HCl.

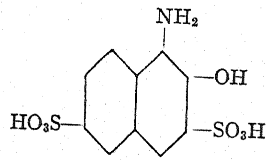
The acetyl deriv., leaflets (alc.), M. P. 235 (turning brown).

Diacetyl deriv., M. P. 264°.

With oxidising agents aqueous solutions of the salts give beta-naphthoquinone.

The carbonyl deriv., small dense prisms, M. P. 206°; the acetyl-carbonyl deriv., reddish needles, M. P. 121°; the benzoylcarbonyl deriv., white needles (alc.), M. P. 256°.

1-Amino-2-naphthol-3, 6-disulphonic Acid (Amino-R-Acid)



$C_{10}H_9NO_7S_2$; Mol. Wt. 319.25; (C, 37.6%; H, 2.8%; N, 4.4%; O, 35.1%, S, 20.1%).

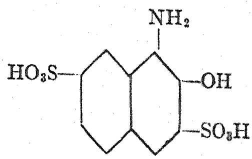
Readily soluble in H_2O. The ammonium solution on filter paper turns green-yellow and gives a pale pink spot with HCl. Gives no reaction with $FeCl_3$ and no colour with diazo compounds or nitro-sodimethylaniline.

Acid Na salt, white silky needles, which are unstable in aqueous solution. $AgNO_3$ is reduced to metallic silver at once. On warming the solution of the acid Na salt complete conversion into 1, 2-dioxynaphthalene-3, 6-disulphonic acid results quickly.

The 1-diazo compounds may be obtained in the presence of $CuSO_4$ in the form of its acid Na salt, yellow curds, readily soluble in H_2O. It couples with resorcinol at once in alkaline solution, giving a deep blue dye, turned brown-red by HCl.

The 1-nitroso deriv. (disodium salt) forms golden yellow cryst. and gives a beautiful red dye with cobalt salts.

1-Amino-2-naphthol-3, 7-disulphonic Acid

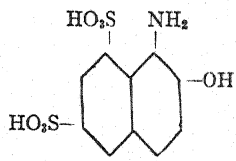


$C_{10}H_9NO_7S_2$; Mol. Wt. 319.25; (C, 37.6%; H, 2.8%; N, 4.4%; O, 35.1%; S, 20.1%).

The acid Na salt forms reddish cryst., difficultly soluble in cold H_2O. It dissolves in alkalies, with a green-yellow colour, and the solutions oxidise in the air only very slowly.

The 1-diazo deriv. may be obtained in the presence of iron salts in the form of its brown-yellow barium salt. It couples with resorcinol in alk. solutions slowly in the cold giving a blue dye, turned brown-red by HCl.

1-Amino-2-naphthol-6, 8-disulphonic Acid (Amino-*g*-acid)



$C_{10}H_9NO_7S_2$; Mol. Wt. 319.25; (C, 37.6%; H, 2.8%; N, 4.4%; O, .35.1%; S, 20.1%).

The acid is readily soluble in H_2O.

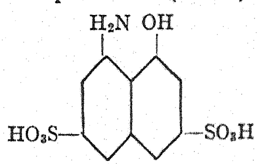
The acid Na salt cryst. in microsc. prisms. A dil. solution reduces $AgNO_3$ only after several minutes (distinction from amino-R-acid which gives immediate reduction).

On boiling the aqueous solution of the acid Na salt a neutral salt of 1, 2-dihydroxynaphthalene-6, 8-disulphonic acid is obtained which is an excellent general precipitant for basic dyes.

The Ba salt of the 1-diazo derivative may be obtained in the presence of $CuSO_4$ as yellow cryst., difficultly soluble in H_2O. It couples with resorcinol only in the presence of hydroxide and upon heating, giving a dark violet dye which gives a fiery red solution with HCl and then a red precipitate.

Ammonium solutions of the amino acid on filter paper turn green-yellow and then red-brown and give an orange scarlet spot with HCl.

1-Amino-8-naphthol-3, 6-disulphonic Acid (H-acid)



$C_{10}H_9NO_7S_2$; Mol. Wt. 319.25; (C, 37.6%; H, 2.8%; N, 4.4% O, 35.1%; S, 20.1%).

Needles, 0.93% dissolves in H_2O at 18°. Gives a brown-red colour with chlorinated pyridine.

Solutions of the neutral salts fluoresce violet and are coloured brown-red by oxidising agents.

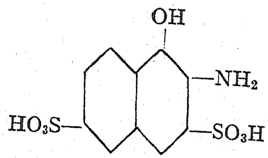
Acid Na salt ($1\frac{1}{2}$ H_2O), fine needles, 0.167 grm. solution in 100 cc. H_2O at 20°, 2.4 grm. at 60°, insoluble in alcohol and ether.

Salt with alpha-naphthylamine, light violet-gray prisms (H_2O), M. P. 278° (decomp.); ps. cumidine, gray prisms (H_2O), M. P. 272° (decomp.); *p*-nitrotoluidine, gray prisms ($1H_2O$), M. P. 265° (decomp.); tolidine, gray-violet prisms ($3H_2O$), M. P. 260° (decomp.). (All of the foregoing salts are soluble in approximately 1,000 parts H_2O at room temperature.)

On heating with dilute alk. H-acid gives chromotropic acid (coloured grass green by $FeCl_3$ and orange-red by bleaching powder solution).

The diazo deriv. forms yellow cryst.

2-Amino-1-naphthol-3, 6-disulphonic Acid



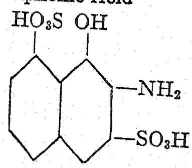
$C_{10}H_9NO_7S_2$; Mol. Wt. 319.25; (C, 37 6%; H, 2.8%; N, 4.4%; O. 35.1%; S, 20.1%).

Sparingly soluble in H_2O. The ammonium solution exposed to air on filter paper is green-yellow, turning dull green and giving a pink spot with conc. HCl. No colour with $FeCl_3$.

Acid Na salt, small silky needles, difficultly soluble in cold H_2O. It dissolves in alkalies, with a weak yellow colour, turning dark green in air. It is so sensitive to nitrite that it is oxidised at once but may be diazotised in the presence of $CuSO_4$.

The acid Na salt of the 2-diazo deriv. forms golden yellow cryst. readily soluble in H_2O. It couples at once with resorcinol giving a blue-red dye turned blue by HCl.

2-Amino-1-naphthol-3, 8-disulphonic Acid

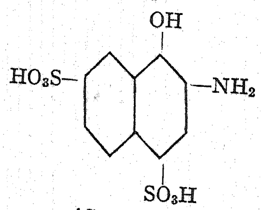


$C_{10}H_9NO_7S_2$; Mol. Wt. 319.25; (C, 37.6%; H, 2.8%; N, 4.4%; O, 35.1%; S, 20.1%).

Cryst. in long colourless needles (H_2O), only mod. sol. in cold. The ammonium solution on filter paper becomes green-yellow and then gives a pink spot with HCl. No reactions with $FeCl_3$ or nitrous acid.

The 2-diazo deriv. may be obtained in the presence of $CuSO_4$ in the form of the deep orange yellow acid Na salt. It couples with resorcinol in alk. sol. only on heating, giving a violet-black dye, turned yellow-red by HCl.

2-Amino-1-naphthol-4, 7-disulphonic Acid

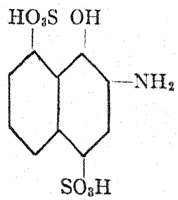


$C_{10}H_9NO_7S_2$; Mol. Wt. 319.25; (C, 37.6%; H, 2.8%; N, 4.4%; O, 35.1%; S, 20.1%).

White needles which dissolves in Na_2CO_3 solution with a yellow colour which gradually turns green. If this solution is warmed a small amount of a dye is formed which colours wool a dirty red.

The 2-diazo derivative may be obtained in the presence of $CuSO_4$ in the form of its acid Na salt, yellow cryst., easily soluble in H_2O. It couples with resorcinol at once, giving a deep blue-red dye turned brown-red by HCl.

2-Amino-1-naphthol-4, 8-disulphonic Acid

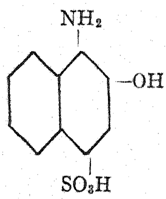


$C_{10}H_9NO_7S_2$; Mol. Wt. 319.25; (C, 37.6%; H 2.8%; N, 4.4%; O, 35.1%; S, 20.1%).

Dissolves in Na_2CO_3 solution giving a brown solution. When this is warmed it turns red-brown and a dye is precipitated which dyes wool green-black.

The 2-diazo deriv. may be obtained in the presence of $CuSO_4$ in the form of its acid Na salt, glittering green-yellow cryst., readily soluble in H_2O. It couples with resorcinol at once in alk. sol. giving a dark violet dye. With HCl the solution turns red and then gives a glittering green precipitate.

1-Amino-2-naphthol-4-sulphonic Acid



$C_{10}H_9NO_4S$; Mol. Wt. 239.19; (C, 50.2%; H, 3.8%; N, 5.9%; O, 26.8%; S 13.4%)

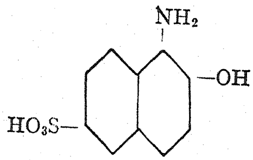
White cryst. powder (also described as yellow needles). Practically insoluble in cold H_2O and only very sparingly soluble in hot H_2O. The Na salt (needles) is sparingly soluble in hot H_2O. Solutions in alkalies are coloured a transitory deep green. Alkaline solutions are oxidised in the air and when warmed yield a brown dye which dissolves in hot H_2O, with a green colour.

"Best characterised by conversion into the reactive β-naphtho-quinone sulphonic acid by the action of HNO_3" (Green). See under 2-Amino-1-naphthol-4- sulphonic acid.

With phenylhydrazine and bisulphite it gives a deep yellow solution and an intensely yellow solid reaction product.

Diazotised in the presence of copper sulphate it gives a green-yellow cryst. diazo comp. (oxide). Coupled with resorcinol in alk. solution it gives a violet-black dye.

1-Amino-2-naphthol-6-sulphonic Acid (Amino-Schaeffer Acid)



$C_{10}H_9NO_4S$; Mol. Wt. 239.19; (C, 50.2%; H, 3.8%; N, 5.9%; O, 26.8%; S, 13.4%).

White or grey-white needles or prisms. Sparingly soluble in cold H_2O and readily so in hot H_2O. Aqueous solutions soon turn brown in the air (more rapidly if alkalies are added), and are turned violet by HCl. (An ammoniacal solution on filter paper is described as giving a brown colour, yielding a lilac spot with HCl which at once becomes pink.) Very difficultly soluble in alc.

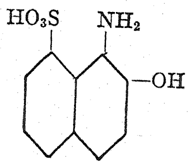
In the presence of sodium acetate it gives a red-violet dye with tetrazostilbene disulphonic acid which is converted into a blue dye by HCl. With diazobenzene-sulphonic acid it gives a fuchsin-red dye, turned bluer and brighter by HCl.

Acid oxidation yields beta-naphthoquinone sulphonic acid.

No reactions are obtained with $FeCl_3$ or nitrous acid, and no dye on heating with nitrosodimethylaniline hydrochloride.

The sodium salt ($2\frac{1}{2}H_2O$) is readily oxidised in the air, particularly in alk. sols., and is used as a developer under the name "Eiconogen."

1-Amino-2-naphthol-8-sulphonic Acid



$C_{10}H_9NO_4S$; Mol. Wt. 239.19; (C, 50.2%; H, 3.8%; N, 5.9%; O, 26.8%; S 13.4%).

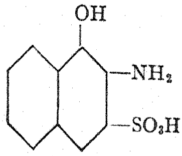
Reddish microsc. leaflets. Very difficultly soluble in boiling H_2O. Dissolves readily in alkalies, the solutions turning orange-brown in the air. The ammoniacal solution on filter paper develops a green-yellow colour, deepening to red-brown, and on spotting with HCl the brown colour is discharged, leaving a bright orange rim. $FeCl_3$ gives a yellow colour. Diazo comps. give brown colour and evolution of nitrogen but no dye formation.

On heating with nitrosodimethylaniline hydrochloride in 50 per cent AcHO a characteristic violet dye is obtained, the aqueous solution of which is turned red by NaOH.

Solutions of the neutral salts fluoresce violet. They are turned dark blue by $FeCl_3$ (then decolorised) and are turned yellow-brown by bleaching powder solution (decolorised by excess).

With nitrous acid it gives a red-orange soluble diazo comp.

2-Amino-1-naphthol-3-sulphonic Acid (Amino-A. W. Acid)



$C_{10}H_9NO_4S$; Mol. Wt. 239.19; (C, 50.2%; H, 3.8%; N, 5.9%; O, 26.8%; S, 13.4%).

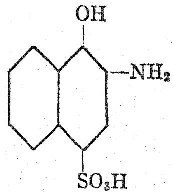
Broad needles, coloured reddish in the air.

An ammoniacal solution in the presence of air gives the characteristic blue "skin" of naphthoquinonimide.

Heated with $ZnCl_2$ and HCl to 106–12° it gives 2-amino-1-naphthol.

The sulphonic acid group is only slightly split off by treatment with sodium amalgam.

2-Amino-1-naphthol-4-sulphonic Acid (Amino-N. W. Acid)



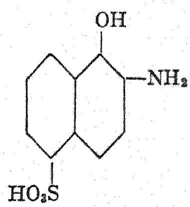
$C_{10}H_9NO_4S$; Mol. Wt. 239.19; (C, 50.2%; H, 3.8%; N, 5.9%; O, 26.8%; S, 13.4%).

Glittering pearly needles and leaflets. Only slightly soluble in cold H_2O, insoluble in alcohol, ether and C_6H_6. The ammoniacal solution on filter paper turns green on exposure to air and gives a bright terra-cotta spot with conc. HCl. (The green colour turns violet and then red on warming, but the green colour is restored by NH_3.) The solution in sodium acetate turns violet on exposure to air. On boiling the acid with a soda solution (with air current) it gives a violet-black dye.

On oxidation with HNO_3 it gives 1.2-naphthoquinone-4-sulphonic acid, which on treatment with an aqueous solution of aniline gives a characteristic scarlet-red anilido-beta-naphthoquinone, M. P. 252–3°.

With conc. HCl the sulphonic acid group is gradually split off at 150°.

2-Amino-1-naphthol-5-sulphonic Acid (Amino L Acid)



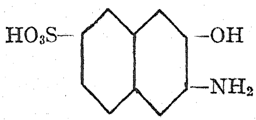
$C_{10}H_9NO_4S$; Mol. Wt. 239.19; (C, 50.2%; H, 3.8%; N, 5.9%; O, 26.8%; S, 13.4%).

Large colourless leaves or long needles, nearly insoluble in cold H_2O.

The sulphonic acid group may be split off by the action of sodium amalgam, and 2-amino-1-naphthol obtained.

Diazotised in the absence of free mineral acids and in the presence of copper chloride a diazo oxide is obtained. The barium salt cryst. in green-yellow cryst., gives a gold-yellow solution and may be coupled with resorcinol in the cold, giving a deep blue-red dye which gives red-brown precipitate with HCl.

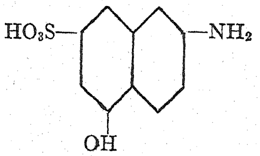
2-Amino-3-naphthol-6-sulphonic Acid



$C_{10}H_9NO_4S$; Mol. Wt. 239.19; (C, 50.2%; H, 3.8%; N, 5.9%; O, 26.8%; S, 13.4%).

Needles, difficultly soluble in hot H_2O. (Soluble in 4,000 parts of H_2O at 15°.) The Ba salt is sparingly soluble.

2-Amino-5-naphthol-7-sulphonic Acid (J-acid)



$C_{10}H_9NO_4S$; Mol. Wt. 239.19; (C, 50.2%; H, 3.8%; N, 5.9%; O, 26.8%; S, 13.4%).

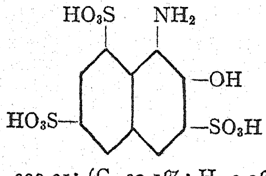
The acid is sparingly soluble in H_2O, the alk. salts readily soluble with a blue fluorescence. Ferric chloride gives a brown-black colour or precipitate.

Anilide, brown powder, difficultly soluble in H_2O and alc. It dissolves in conc. H_2SO_4, with a green colour, in dil. soda sol. with a violet fluorescence and in sodium acetate solution without fluorescence.

The diazo comp. of J-acid is yellow and gives a violet product with sodium carbonate solution. The N-acetyl and benzoyl derivatives are not diazotised.

Heated with sodium bisulphite the acid yields a dioxydinaphthylamine disulphonic acid, fine white needles, readily soluble in H_2O. The sodium salt dissolves in H_2O with a weak blue-violet fluorescence.

1-Amino-2-naphthol-3, 6, 8-trisulphonic Acid

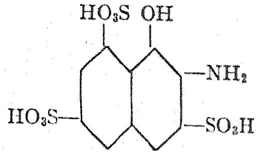


$C_{10}H_9NO_{10}S_3$; Mol. Wt. 399.31; (C, 20.1%; H, 2.3%; N, 3.5%; O, 40.1%; S, 24.1%).

The Na salt forms minute yellow cryst., readily soluble in cold H_2O. It dissolves in alkalies with a yellow colour and a green fluorescence.

The corresponding salt of the 1-diazo derivative is obtained in the presence of $CuSO_4$ as orange-yellow cryst. It couples with resorcinol in alk. sol. on heating, giving a red-violet dye which turns fiery red with HCl.

2-Amino-1-naphthol-3, 6, 8-trisulphonic Acid

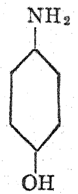


$C_{10}H_9NO_{10}S_3$; Mol. Wt. 399.31; (C, 20.1%; H, 2.3%; N, 3.5%; O, 40.1%; S, 24.1%).

The acid Na salt forms microsc. cryst., faintly rose coloured, mod. sol. in cold H_2O. It gives orange-yellow solutions with excess alkali which turn dark green slowly in the air.

The acid Na salt of the 2-diazo derivative is obtained in the presence of $CuSO_4$ as a red-yellow, slightly cryst. precipitate, readily soluble in H_2O. It forms a dark blue dye on warming with an alkaline solution of resorcinol, which is turned brown-red by HCl.

4-Aminophenol (*p*-aminophenol)



C_6H_7NO; Mol. Wt. 109.09; (C, 66%; H, 6.5%; N, 12.8%; O, 14.7%).

White plates or leaflets, M. P. 184° (decomp.). Sublimes in part unaltered. 100 cc. H_2O dissolve 1.1 gm. at 0°, alc., 4.5 gm. Readily oxidised. Alkaline solutions turn violet in air rapidly.

Monoacetyl deriv., colourless monocl. prisms (H_2O), M. P. 168–9°; diacetyl deriv., leaflets (H_2O), M. P. 150–1°.

Hydrochloride, prisms, sol. in 1.4 parts H_2O at 0°; acetate, M. P. 183°; tartrate, scales, M. P. 232°; bitartrate, M. P. 216°, readily soluble in hot H_2O.

Salts with benzoic, amino-benzoic and sulphanilic acids (*see J. pr. Chem.*, 2, 83, 233).

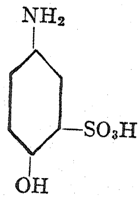
Condensation prod.: with sym. trinitrobenzaldehyde, 2, 4, 6-trinitrobenzal-*p*-aminophenol, yellow, M. P. 179°; with tetryl, 2, 4, 6-trinitro-4-hydroxydiphenylamine, brick red needles, M. P. 174°; with 1, 3, 4, 6-bromtrinitrobenzene, 5-brom-2, 4-dinitro-4^1-hydroxydiphenylamine, garnet-red prisms, M. P. 215–6°; with gamma-trinitrotoluene, 2-4-dinitro-5-methyl-4^1-hydroxydiphenylamine, garnet-red prisms, M. P. 194° (gives an acetyl deriv. yellow plates, M. P. 144–5°).

Does not yield nitrogen when heated with nitrous acid (general test for amino groups).

A sol. of the hydrochloride poured into a solution of bleaching powder gives a violet colour, turning green on shaking (quinone chlorimide formation).

Is oxidised to quinone by chromic acid, etc.

4-Aminophenol-2-sulphonic Acid



$C_6H_7NO_4S_2$; Mol. Wt. 189.15; (C, 38.1%; H, 3.7%; N, 7.4%; O, 33.8%; S, 16.9%).

Long needles, hexagonal plates or large wedge-shaped cryst. Cryst. with 1. mol. H_2O (lost at 100°). Stable if sl. acid but turns brown in moist air, in presence of NH_3 and on heating. Decomp. without melting. Soluble in about 1,500 parts H_2O at 14°, insoluble in alcohol and ether. Reduces ammon. $AgNO_3$ in cold. Is coloured violet by $FeCl_3$. Not precipitated by lead acetate.

Does not form salts with acids. The metallic salts are not particularly characteristic (including those of the benzoyl deriv.).

Anilide, colourless needles (alc., H_2O) or small dense cryst. ($AcHOH_2O$), M. P. 98°.

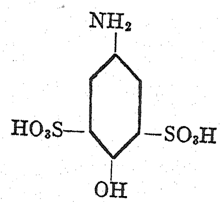
On dry distil. (unlike the *o*-amino isomer) it gives a dark violet dye ($C_{18}H_{15}NO_3$), cobalt-blue sol. with alkalies.

Gives a colourless diazo deriv. (H_2O) which turns yellow with alkalies and gives a pale yellow brucine salt.

If a suspension in AcHO is treated with bromine a yellow precipitate is obtained of bromanil ($C_6Br_4O_2$), which sublimes at about 220° and melts at about 300°

By heating with HCl to 180° it gives *p*-aminophenol hydrochloride (base, M. P. 183°).

4-Aminophenol-2, 6-disulphonic Acid



$C_6H_7NO_7S_2$; Mol. Wt. 269.21; (C, 26.8%; H, 2.6%; N, 5.2%; O, 41.6%; S, 23.8%).

White, silky, deliquescent needles, difficultly soluble in alcohol, insoluble in ether.

The acid alkali salts are difficultly soluble in H_2O, the neutral lead salt nearly insoluble.

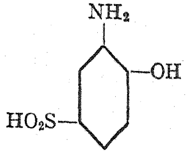
Solutions of the acid and its salts gives a violet colour with $FeCl_3$.

Dilute alkaline salt solutions show a characteristic blue fluorescence which is transitory (with alkali carbonates this is replaced soon by a green colour).

Gives a yellow diazo deriv., small needles, soluble in H_2O, insoluble in alcohol.

For characteristics of isomeric acid, see D. R. P., 65236 (Friedl., III, 56).

2-Aminophenol-4-sulphonic Acid



$C_6H_7NO_4S$; Mol. Wt. 189.15; (C, 38.1%; H, 3.7%; N, 7.4%; O, 33.8%; S, 16.9%).

Colourless rhombohedra or monocl. prisms. ($\frac{1}{2}H_2O$). Soluble in about 100 parts H_2O at 14°. Somewhat unstable in boiling H_2O. Decomposes without melting.

Does not form salts with acids. Alkali salts readily soluble; Ba salt, difficultly soluble in H_2O and alcohol, colourless if pure; Cu salt, clear green needles; Co salt, red precipitate.

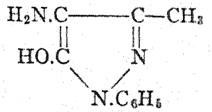
Na salt of benzoyl deriv. ($4\frac{1}{2}H_2O$), colourless (if pure), easily soluble in H_2O and alcohol.

Anilide ($C_6H_3.OH.NH_2.SO_2NHC_6H_5$), needles, M. P. 205, insoluble in ether or ligroin, readily soluble in alcohol, C_6H_6 and AcHO.

Gives a yellow diazo deriv. (H_2O, lost at 80°), the colour being practically unaffected by alkalies or acids.

Polyazo deriv.—See D. R. P. 45994, Friedl, II, 319.

1-Phenyl-3-methyl-4-amino-5-pyrazolone

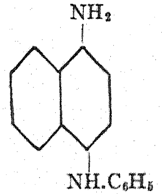


$C_{10}H_{11}N_3O$; Mol. Wt. 189.16; (C, 63.5%; H, 5.9%; N, 22.2%; O, 8.5%).

The hydrochloride, needles, is difficultly soluble in dil. HCl.

The base is unstable and oxidises in air quickly to rubazonic acid, red needles (AcOH), insoluble in H_2O and dil., acids, soluble in alkalies, with a deep violet colour, difficultly soluble in alcohol and AcHO and readily soluble in benzene, ether and $CHCl_3$.

4-Amino-1-phenyl-naphthylamine



$C_{16}H_{14}N_2$; Mol. Wt. 234.21; (C, 82.0%; H, 6.0%; N, 12.0%).

Glittering leaflets (benzene), M. P. 148°.

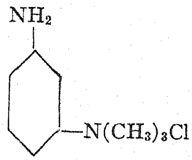
Acetyl deriv.: leaflets, M. P. 192°, readily soluble in alcohol but nearly insoluble in ligroin.

Oxidised by HgO to 1, 4-naphthoquinonephenyldiimide, yellow-red glittering cryst., M. P. 128–9°, readily soluble in alcohol, ether or benzene.

On heating with benzaldehyde, it yields 4-phenylbenzalnaphthylenediamine, green-yellow cryst. (abs. alc.), M. P. 109°, readily soluble in ether and benzene.

On boiling with CS_2 and alcohol it yields 4-phenylnaphthylene-diamine-thiourea, sparingly sol. cryst., M. P. 196°.

3-Aminophenyl-trimethylammonium Chloride

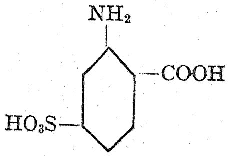


$C_6H_{15}N_2Cl$; Mol. Wt. 186.64; (C, 57.9% ; H, 8.1%; N, 15.0%; Cl, 19.0%).

Colourless rhombic plates very readily soluble in H_2O or hot alcohol. The hydrochloride cryst. in colourless prisms, easily soluble in H_2O. It gives a $ZnCl_2$ double salt, dense colourless prisms, readily soluble in H_2O but nearly insoluble in abs. alc.

(For dyes obtained by diazotisation and coupling see Friedlander, IV, 809, 810 and 819.)

2-Amino-4-sulphobenzoic Acid



$C_7H_7NO_5S$; Mol. Wt. 217.16; (C, 38.7%; H, 3.3%; N, 6.4%; O, 36.8%; S, 14.8%).

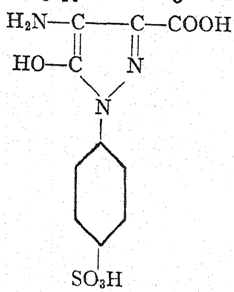
Colourless rhombic plates (yellowish when impure) containing one-half mol. H_2O. The hydrated acid darkens at 240°, but fails to melt at 250°. Slightly soluble in cold H_2O, almost insoluble in $CHCl_3$ and ether. Forms both an acid and neutral series of salts. The acid and its salts have a bluish-purple fluorescence in dilute solutions.

The di-silver salt with ethyl iodide gives *o*-monoethylamino-*p*-sulphobenzoic acid, yellow rhombs, M. P. 243° (decomp.).

It may be converted into 4-sulphophenyl-2-thioglycol-1-carboxylic acid which gives characteristic thioindigo derivs. (Ber. 49, 956).

100 grm. aqueous solution contain 1.048 grm. acid at 25°.

4-Amino-1-(4-sulphobenzene)-5-pyrazolone-3-carboxylic Acid

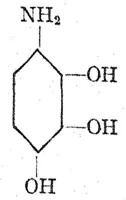


$C_{10}H_9N_3O_6S$; Mol. Wt. 299.21; (C, 40.1%; H, 3.0%; N, 14.0%; O, 32.1%; S, 10.7%).

Heavy small needles, almost insoluble in cold H_2O, alc. and AcHO. It is decomp. on heating without melting. Solutions in alkalies become coloured violet in the air. A sol. of the acid also turns dark violet with conc. H_2SO_4.

Acid Na salt, small, faintly reddish cryst.

4-Amino-1.2.3-trihydroxybenzene (4-aminopyrogallol)



$C_6H_7NO_3$; Mol. Wt. 141.09; (C, 51.1%; H, 5.0%; N, 9.9%; O, 34.0%).

Free base is unstable, being readily oxidised.

Hydrochloride, brownish needles or nearly colourless fine needles (alc.—Ac HO). Readily soluble in H_2O, difficultly soluble in ethyl acetate. Solutions of hydrochloride are readily oxidised in air, aqueous solutions turning dark violet and alcoholic solutions brown. On adding alkali and shaking gives an intense blue colour, becoming more violet on standing; with ammonia a blue colour turning dark red (Barth). $FeCl_3$ gives an intense blue colour, soon turning brown.

Heated with benzoyl chloride it gives dibenzoyldioxyphenyl-benzoxazol, white needles (benzene-gasoline), M. P. 144°. Aqueous solutions of this are unaffected by alkalies or $FeCl_3$.

Aniline.

C_6H_7N; Mol. Wt. 93.09; (C, 77.4%; H, 7.6%; N, 15.0%).

Colourless refractive oil, readily volatile with steam. M. P. −6 to −7°. B. P. 80–1° at 20 mm., 100° at 50 mm., 184.4° at 760 mm. D = 1.027 at 15°. Saturated aqueous solution contains 3.61% at 13.8°, 3.66% at 22.7°, 4.3% at 52°, 6.12% at 86.6°.

Monoacetyl deriv., (acetanilide), M. P. 114.3° cor. B. P. 170° at 11 m.m., 226–7° at 100 m., 305° cor. at 760 mm. 100 c.c. H_2O dissolve 0.54 grm. at 25°, 100 cc. alc. 46.7 grm. Gives phenylglycine with chloroacetic acid (heat), colourless cryst, M. P. 127°.

Diacetyl deriv.: glistening plates, readily soluble in C_6H_6, toluene and ligroin, slightly soluble in cold H_2O. M. P. 37–37.5°. B. P. 142° at 11 mm., 199–200° at 100°.

Benzoyl deriv., M. P. 163°; dibenzoyl deriv., M. P. 160–1°.

Hydrochloride: very soluble gray monocl. needles, M. P. 198°, B. P. 245° (decomp.). Picrate: transp. cryst.; darken at 165° (decomp.). H_2O dissolves 0.45% at 17.5°, alc. (95%) dissolves 8.4%. Oxalate, M. P. 161–2°. Tartrate, M. P. 191° cor. (decomp.); acid tartrate; M. P. 187–8° cor. (decomp.); Benzoate: long colourless silky needles (light petroleum), M. P. 90°. (For characteristic substitute benzoates, see *J. Chem. Soc.*, **75**, 580.)

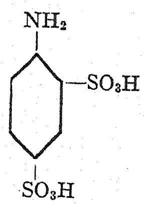
Benzene sulphonate; M. P. 240°, 11.3% sol. in H_2O at 19°. α-Naphthalenesulphonate; M. P. 183°, 1.58% sol. in H_2O at 15°. β-Naphthalenesulphonate; M. P. 269°, .52% sol. in H_2O at 15°. 2, 6-Naphthalenedisulphonate; M. P. 251–2°, 3.9% sol. in H_2O at 15°. 2, 7-Naphthalenedisulphonate; M. P. > 345°, .82% sol. in H_2O at 15°. α-Anthraquinone sulphonate; needles, M. P. 284°. β-Anthraquinone sulphonate; needles, M. P. 309°, sol. in 1700 pts. H_2O.

Additive comp.: With trinitrobenzene (sym.) glittering red leaflets, mod. sol. in warm C_6H_6, M. P. 123–4°; with picramide, glittering dark red cryst., M. P. 123–5°; with α-trinitrotoluene, long glistening red needles, M. P. 83–4°; with tetryl, orange-red plates (C_6H_6), M. P. 64°; with 2, 4, 6-trinitrobenzaldehyde, red plates (alc.), M. P. 86°; with 2, 4, 6-trinitrostilbene, orange-red leaflets, M. P. 103–5°; with 2, 6-dinitrohydroquinone, dark red needles, M. P. 102–3° (decomp.).

Condensation prod. with: 1-halogen-2-naphthol, 1-phenylamino-2-hydroxy naphthalene, M. P. 155–6°, (methylether, M. P. 82–3°); with excess benzene-sulponyl chloride, dibenzolsulphonanilide, M. P. 128–9°; with tetranitraniline, 2, 4, 6-trinitro-3-aminodiphenylamine, orange-yellow, M. P. 188°; with 1-chlor-2, 4-dinitro benzene, 2, 4-dinitrodiphenylamine, M. P. 155–6°; with 1-brom-3, 4, 6-trinitrobenzene, 5-brom-2, 4-dinitrodiphenylamine, garnet-red prisms, M. P. 156°; with tetryl, 2, 4, 6-trinitrodiphenylamine, M. P. 178°; with 2, 4, 6-trinitrobenzaldehyde, 2, 4, 6-trinitrobenzalaniline, yellow cryst. M. P. 220° (decomp.).

Diazotised and coupled with: β-naphthol, red needles, M. P. 131°, red sol. in H_2SO_4, orange precipitate on dil.;—Naphthol AS, minute red needles (HOAc), M. P. 237°, red sol. in H_2SO_4, red precipitate on dil.;—1-Naphthol-2-sulph. acid, abs. data, *J. Assoc. Off. Agric. Chem.*, 6, 16. With bleaching-powder sol. and dil. $(NH_4)_2S$ aniline gives a blue colour, turning violet and then fading.

Aniline-2, 4-disulphonic Acid



$C_6H_7NO_6S_2$; Mol. Wt. 253.21; (C, 28.5%; H, 2.8%; O, 37.9%; S, 25.3%).

Brownish-red warts of microscopic. cryst. (2 or 2½ H_2O). Readily soluble in H_2O and alc., insoluble in ether. Decomp. above 120°.

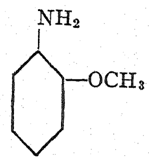
Gives mono- and di-basic metallic salts, the latter being more soluble. Chloride, M. P. 63°.

Amide, glistening leaflets (H_2O), M. P. 235° (Fischer); M. P. 229° (Limpricht).

With bromine water gives tribromaniline, M. P. 118.5°.

Heated with alc. under pressure gives *m*-disulphobenzene which gives a cryst. chloride, M. P. 61°.

Anisidine



C_7H_9NO; Mol. Wt. 123.12; (C, 68.3%; H, 7.4%; N, 11.4%; O, 13.0%).

Oil. M. P. 5°; B. P. 225° (cor.); D., 1.0914 at 25°. Very solubie in alcohol and ether, very slightly soluble in H_2O.

Acetyl deriv., M. P. 84°, B. P. 303–5°.

Salts with: 1-naphthalene sulph. acid, M. P. 208°, 100 grm. aqueous solution at 10° contain 0.85 grm. salt; 2-naphthalene sulph. acid, M. P. 207°, 100 grm. aqueous solution at 15° contain 0.26 grm. salt; 2, 7-naphthalene

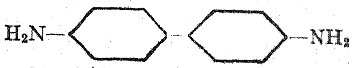
disulph. acid. M. P. 229°, very soluble; 2, 6-naphthalene disulph. acid, M. P. > 295°, 100 cc. aqueous solution at 15° contain 2.45 grm. salt.

Additive comp. with: Sym. trinitrobenzene, glistening, brownish-red plates (alc.), M. P. 98° (cor.); 1. 3-5-trinitro-naphthalene, black cryst. (acetone), M. P. 128°.

Condensation product with: 2, 4-dinitrobenzaldehyde, yellow, M. P. 140°, insoluble in H_2O but very soluble in org. solv.; 2, 4, 6-trinitrobenzaldehyde, yellow cryst. (chloroform), M. P. 171.5; tetryl (giving 2', 4', 6'-trinitro-2-methoxydiphenylamine), red cryst. (alc.), M. P. 143°.

Diazotised and coupled with : β-naphthol, red cryst. powder with bronze reflex (glacial AcOH), M. P. 180°, magenta-red sol. in H_2SO_4, red precipitate on dil.; Naphthol AS, red needles (toluene), M. P. 229°, violet sol. in H_2SO_4, bluish-red precipitate on dil.

Benzidine (4, 4'-diaminodiphenyl)



$C_{12}H_{12}N_2$; Mol. Wt. 184.17; (C, 78.2%; H, 6.6%; N, 15.2%).

Large colourless silky plates or white leaflets. M. P. 127.5–8°, B. P. 400–1° at 740 mm. Sol. in about 2,500 parts H_2O at 12° or about 106 parts boiling H_2O, and in 45 parts ether. Readily soluble in alcohol.

Salts: Hydrochloride, thin rhombic plates, readily soluble; Sulphate, small shining scales, only slightly soluble in hot H_2O and alcohol; chromate, characteristic deep blue needles; 1, 8-dinitro-naphthalene-3, 6-disulphonate, light yellow prisms, M. P. 275° (decomp.) sol in 2,777 parts H_2O at 20°; chromotropate, brown prisms, M. P. 278°, sol. in 1,777 parts H_2O at room temp. For other benzene and naphthalene sulphonates see *J. Soc. Chem. Ind.*, 1924, **43**, 165, 299, 341.

Additive comp.—with acetoacetic ether, yellow leaflets, M. P. 128°, coloured intense green by $FeCl_3$; *m*-dinitrobenzene, black cryst., M. P. 128°; sym. trinitroethylbenzene, black prisms (alc.) M. P. 73°; 1, 3, 6, 8-tetranitronaphthalene, black prisms (xylene), M. P. 194°; N-methyl-pyridinum iodide, yellow needles, M. P. 154°, unstable in hot H_2O.

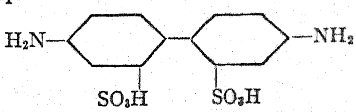
With bromonitro-styrene, dibenzylidene benzidine is obtained, plates (C_6H_6), M. P. 231–2°.

Diazotised and coupled with: β-naphthol, dark cryst., powder with green reflex (toluene), M. P. 302°, blue solution in H_2SO_4, blue-violet precipitate on dil.; Naphthol AS, dark violet cryst. powder M. P. over 320°, blue solution in H_2SO_4, blue-violet precipitate on dil.

Monoacetyl deriv., long needles (alc.), M. P. 199°; diacetyl deriv., M. P. reported variously as 315°, 317° and 330–1°; triacetyl deriv., M. P. 215–6°; tetracetyl deriv., long silky needles, M. P. 214–5° (also reported as 176°); 4-nitroso-4'-acetyl deriv., yellow-brown feathery needles which darken at 200° and are completely melted at 275°; benzoyl deriv., cryst. (alc.), M. P. 203–5°; dibenzoyl deriv., prisms (phenol), M. P. 352°.

Dilute aqueous solutions of benzidine give heavy deep blue precipitates with pot. dichromate or ferricyanide. On adding dil. bromine water to a sol. of benzidine in CS_2 the aq. layer is coloured deep blue and then deep green; with further addition of bromine the aq. layer becomes colourless and the CS_2 is coloured deep red.

Benzidine-2, 2'-disulphonic Acid



$C_{12}H_{12}N_2O_6S_2$; Mol. Wt. 344.29; (C, 41.8%; H, 3.5%; N, 8.0%; O, 27.9%; S, 18.6%).

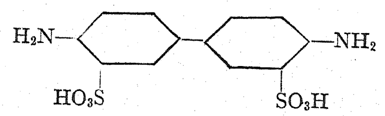
Monoclinic prisms ($+3H_2O$), which lose water at about 175° and char without melting. Nearly insoluble in alcohol and ether. Less than .1% dissolves in cold H_2O and rather difficultly soluble in hot H_2O.

Na salt ($+3\frac{1}{2}\ H_2O$), large yellowish monoclinic prisms, Ca salt ($+4H_2O$), monoclinic prisms, soluble in about 26 parts H_2O at 9°; Ba salt ($+4H_2O$), prisms, soluble in about 104 parts H_2O at 26°.

Amide, needles, M. P. 278°. Its hydrochloride ($+2H_2O$) cryst. in large prisms, M. P. 205°.

On alk. fusion the acid yields 4, 4′-diaminodiphenyleneoxide, needles, M. P. 150–2°.

Benzidine-3, 3′-disulphonic Acid



$C_{12}H_{12}N_2O_6S_2$; Mol. Wt. 344.29; (C, 41.8%; H, 3.5%; N, 8.0%; O, 27.9%; S, 18.6%).

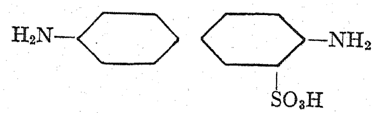
Very small leaflets, nearly insoluble in alcohol and ether and only very slightly soluble in boiling water. Aqueous solutions are coloured green by bromine water.

The Ba salt ($+5H_2O$) cryst. in thin glittering leaflets. Heated at 150° with insufficient H_2O for solution it yields short thick needles containing only $2H_2O$.

The acid dissolves in strong mineral acids with the formation of unstable acid salts.

It may be converted into 3, 3′ dihydroxydiphenyl, needles, M. P. 123.5°, by deamination followed by alkali fusion.

Benzidine-3-sulphonic Acid



$C_{12}H_{12}N_2O_3S$; Mol. Wt. 264.23; (C, 54.5%; H, 4.6%; N, 10.6%; O, 18.2%; S, 12.1%).

Leaflets, difficultly soluble in H_2O, insoluble in alcohol and ether.

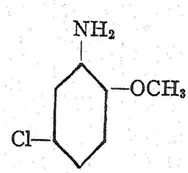
The hydrochloride (1HCl) is decomp. by boiling with H_2O, with loss of HCl.

Ba salt ($+5H_2O$), needles or leaflets, mod. easily soluble in boiling H_2O.

The diacetyl deriv. forms a Na salt which cryst. in long needles, difficultly soluble in cold H_2O, readily in hot H_2O.

The acid gives a red-brown colour with chlorinated pyridine. On oxidation with warm alk. $K_3Fe(CN)_6$ it yields a red azoxy dye which is readily soluble in hot H_2O.

4-Chlor-2-amino Anisol



C_7H_8ClNO; Mol. Wt 157.57; (C, 53.3%; H, 5.1%; Cl, 22.5%; N, 8.9%; O, 10.2%).

Needles, M. P. 82°, readily soluble in alcohol, with difficulty in ligroin. Volatile with steam.

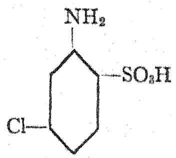
Picrate, needles, M. P. 194° (decomp.).

Acetyl deriv., needles (H_2O), M. P. 104°. On nitration this gives a nitro-acetyl deriv. which melts at 193°.

Diazotised and coupled with β-naphthol, dark red, prismatic needles with green reflex, M. P. 203°, red-violet sol. in H_2SO_4, red precipitate on dil.; Naphthol AS, dark red, prismatic needles (toluene), M. P. 237°, blue sol. in H_2SO_4, bluish-red precipitate on dil.

The amino group may be replaced by Cl, giving 2,4-dichlor-anisole, orthorh. prisms, M. P. 27–8°, B. P. 232–3° at 743.5 m.m., 125° at 100 m.m.

3-Chloraniline-6-sulphonic Acid



$C_6H_6ClNO_3S$; Mol. Wt. 207.61; (C, 34.7%; H, 2.9%; Cl, 17.1%; N, 6.7%; O, 23.1%; S, 15.4%).

Red-brown glittering rhombohedra, difficultly soluble in H_2O.

Na salt (+½ H_2O), yellow needles, or (+2H_2O) colourless needles.

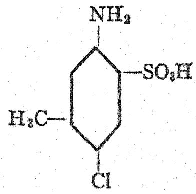
Na salt (+H_2O), small yellow needles, soluble in alcohol, effloresces.

Sr salt (+9H_2O), long colourless needles, readily soluble in H_2O and alcohol, effloresces.

By elimination of amino group yields *p*-chlorbenzene-sulphonic acid;—chloride, needles (ether), M. P. 52–3°; —sulphonamide, yellow cryst., M. P. 140°.

May also be converted into *o*-chlorbenzenesulphonic acid by treatment with Na amalgam and replacement of amino group by chlorine;—sulphonamide, M. P. 187°.

2-Chlor-5-toluidine-4-sulphonic Acid



$C_7H_8ClNO_3S$; Mol. Wt. 221.63; (C, 37.9%; H, 3.6%; Cl, 16.0%; N, 6.3%; O, 21.7%; S, 14.5%).

White powder or thin, colourless, anhydrous plates which readily turn red in light and air. Rather difficultly soluble in H_2O.

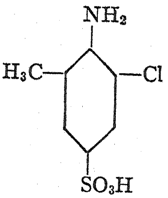
Solutions in sod. acetate are coloured brown by $FeCl_3$.

The diazo deriv. is almost colourless and is only moderately soluble.

Aqueous solutions of the acid decolorise bromine water instantly, even in the cold, giving 6-chlor-2,4-dibrom-*m*-toluidine, long, colourless needles, M. P. 99.5°, soluble in hot alcohol.

By heating the acid with 75% H_2SO_4 2-chlor-5-toluidine is obtained, cryst., M. P. 83°, B. P. 241°. The nitrate of the later comp. melts at 165° (decomp.); 100 pts. H_2O dissolve 5.014 pts. nitrate at 17°.

3-Chlor-2-toluidine-5-sulphonic Acid

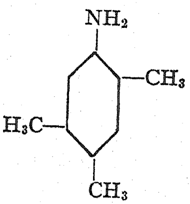


$C_7H_8ClNO_3S$; Mol. Wt. 221.63; (C, 37.9%; H, 3.6%; Cl, 16.0%; N, 6.3%; O, 21.7%; S, 14.5%).

Needles, readily soluble in hot H_2O. The diazo comp. is also readily soluble.

By heating with 75% H_2SO_4 at 150–60° the sulphonic grp. is split off, forming 3-chlor-2-aminotoluol.

Pseudo-cumidine



$C_9H_{13}N$; Mol. Wt. 135.16; (C, 79.9%; H, 9.7%; N, 10.4%).

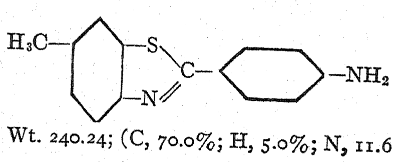
Large lustrous prisms, M. P. 62–4° (also given as 68°). B. P. 234–6°. Insoluble in H_2O but readily soluble in alcohol. Acetyl deriv., long colourless needles, M. P. 161° (also given as 164–5°). On nitration it gives a 6-nitro deriv., small, colourless, glassy needles, M. P. 199.5° (cor.). On reduction this gives a colourless benzimidazole, silky needles, M. P. 232° (cor.).

Diacetyl deriv. hard, transparent prisms, M. P. 59.5°, soluble in org. solvents but insoluble in H_2O.

Salts.—Nitrate is very sparingly soluble in H_2O; *m*-nitrobenzoate, needles, M. P. 140–1°, readily soluble in cold alcohol; sym. trinitrobenzoate, yellow-brown feathery needles which darken at 150° and melt at 155° (decomp.), rather easily soluble in boiling H_2O; amino-sym tribrombenzoate, colourless felted needles (boiling H_2O), M. P. 175°; benzenemonosulphonate, M. P. 217°, soluble in 49 parts H_2O at 16; alpha-naphthalenesulphonate, M. P. 198°, soluble in 526 parte H_2O at 14°, β-naphthalene-sulphonate, M. P. 236°, soluble in 2,000 parts H_2O at 10°; 2, 6-naphthalene disulphonate, M. P. > 369°, soluble in 1,111 parts H_2O at 15; 2, 7-naphthalene disulphonate, M. P. 329–30°; salt of H-acid, gray prisms, M. P. 272° (decomp.), soluble in 1,031 parts H_2O at room temp. and but little more soluble in hot H_2O.

Additive comp. with: sym. trinitrobenzoic acid, M. P. 140–3°; 1, 3, 5-trinitronaphthalene, black needles (C_6H_6), M. P. 101°; 1, 3, 6, 8-tetranitronaphthalene, black needles (C_6H_6), M. P. 155°.

Dehydrothio-*p*-toluidine



$C_{14}H_{12}N_2S$; Mol. Wt. 240.24; (C, 70.0%; H, 5.0%; N, 11.6%; S, 13.3%).

Glittering yellow needles (alc.), M. P. 190–1° (also reported as 185°), B. P. 434°. Soluble in 20,000 parts boiling H_2O, sp. sol. in cold alc., readily soluble in AcHO. Alc. sols. fluoresce violet-blue.

On ignition with zinc dust it yields *p*-toluidine.

Heated with S it yields primuline base and evolves H_2S. With nitrous acid it gives a phenol, needles (alc.), M. P. 255–6°, alk. sols. of which fluoresce blue.

Its salts are sparingly sol. in general and unstable in H_2O. Picrate, M. P. 204–6°; chlorplatinate decomposed at 230–40°.

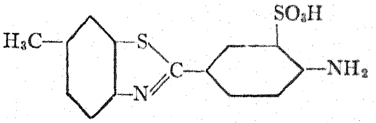
Acetyl deriv., small prisms (alc.), M. P. 225–7°, sp. sol. in AcHO, nearly insoluble in alcohol.

On diazotisation dehydrothio-*p*-toluidine yields a brown-yellow insoluble product M. P. 270° and a soluble product, M. P. 139°, which may be coupled with (alk.) β-naphthol, yielding an azo dye crimson needles, M. P. 214°, soluble in H_2SO_4, with a violet colour.

Heated in conc. H_2SO_4 with glycerin and arsenic acid it yields the corresponding quinoline, pale brown cryst. (alc.), M. P. 147° (cor.).

With benzaldehyde it yields a benzal deriv. yellow needles or plates (alc.), M. P. 193° (cor.).

Dehydrothio-*p*-toluidine Sulphonic Acid



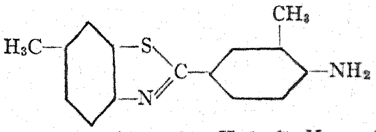
$C_{14}H_{12}N_2O_3S_2$; Mol. Wt. 320.30; (C, 52.5%; H, 3.8%; N, 8.7%; O, 15.0%; S, 20.0%).

Yellow needles ($+1H_2O$) or orange leaflets ($+2H_2O$) nearly insoluble in cold H_2O alcohol or ether. Its salts fluoresce blue. It yields a sparingly sol. yellow diazo comp., stable even in boiling H_2O.

NH_4 salt ($+H_2O$), small silvery white plates which turn yellowish on drying, sparingly sol. in cold H_2O.

Na salt, yellow powder readily soluble in H_2O. Treated with NaOCl it yields Chlorophenine Y. Cu salt, brown-red, insoluble.

Dehydrothio-*m*-xylidine

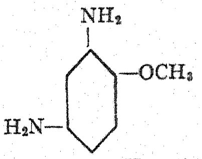


$C_{16}H_{16}N_2S$; Mol. Wt. 268.28; (C, 71.6%; H, 6.0%; N, 10.4%; S, 12.0%).

Yellow-white prisms (alc.), M. P. 107°, B. P. 283° at 14 mm. Insoluble in H_2O, sp. sol. in cold alc., readily soluble in hot alcohol. Its salts are decomposed by H_2O. The diazo deriv. is readily soluble. On sulphonation it yields a sparingly sol. yellow acid of which the salts are colourless.

Acetyl deriv., needles (alc.), M. P. 227°.

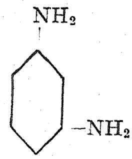
2, 4-Diamino Anisole



$C_7H_{10}N_2O$; Mol. Wt. 138.13; (C, 60.8%; H, 7.3%; N, 20.3%; O. 11.6%).

Gives a characteristic indamine with nitrosodimethylaniline hydrochloride, brown-red needles (C_6H_6), M. P. 258°.

1.3-Diaminobenzene (*m*-**phenylenediamine**)



$C_6H_8N_2$; Mol. Wt. 108.11; (C, 66.6%; H, 7.5%; N, 25.9%).

Dimorphic; alpha-form (above 36°), brown needles, beta-form (below 36°) mauve plates. May be "frozen out" of 40% sol. at 0° in beautiful white prisms ($+\frac{1}{2}H_2O$). Readily sol. in H_2O and org. solv. M. P. 62.8°. B. P. 282–4° (287°, Green). May be distilled in vacuo.

Monoacetyl deriv.: Flat needles (from C_6H_6 in which it dissolves with difficulty). Readily soluble in H_2O, alc. and acetone. M. P. 86.5–87.5° (cor.) The hydrochloride, transp. plates (alc.). M. P. 248–51°. Readily diazotised. Diacetyl (N, N[1]) deriv.; M. P. 191°, prisms (alc.). *m*-Chloracetylamino acetanilide; radiating delicate cryst. (alc.), M. P. 212–14°.

Benzene sulphonate: M. P. >320°, 19% soluble in H_2O at 17°.

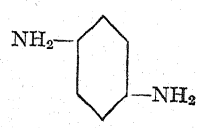
β-Naphthalene sulphonate: M. P. 275°, 1.27% solution in H_2O at 17°.

Hexabromoplatinate: dark red glittering rhombic needles, M. P. 270°.

Additive comp.:—with 1, 3, 5-trinitronaphthalene, brown needles (alc. and C_6H_6), M. P. 170°; with tetryl, silky brown needles (C_6H_6), M. P. 84°.

Condensation prod.;—with γ-trinitrotoluene, 2, 4-dinitro-5-methyl-3[1]-aminodiphenylamine, red yellow, M. P. 160–1° (acetyl deriv. red yellow, M. P. 244–5°); with α-dinitrochlorbenzene, M. P. 172°; with tetryl, 2, 4, 6-trinitro-3[1]-aminodiphenylamine, deep red cryst., M. P. 207°. Acetyl deriv., M. P. 212°; benzoyl deriv., M. P. 172°; *m*-phenylenediamine gives an orange-red or orange-brown colour with acid solutions of nitrites.

1.4-Diaminobenzene (*p*-**phenylenediamine**)



$C_6H_8N_2$; Mol. Wt. 108.11; (C, 66.6%; H, 7.5%; N, 25.9%).

Monoclin. cryst. M. P. 140–147°. B. P. 267°. Mod. sol. in H_2O.

Acetyl deriv., long needles (H_2O), M. P. 162° cor. Diacetyl deriv., yellow-green cryst., M. P. 160°.

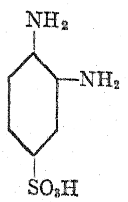
Dibenzoyl derivative, M. P. 222°.

Benzenesulphonate, M. P. >320°, 2.57% sol. in H_2O at 10°; α-naphthalene sulphonate, M. P. >330°, .26% sol. in H_2O at 10°; β-naphthalene-sulphonate, M. P. >330° .07% sol. in H_2O at 15°.

Condensation prod., with γ-trinitrotoluene gives 2, 4-dinitro-5-methyl-4[1]-aminodiphenylamine, garnet-red, M. P. 174–5° (acetyl deriv., orange, M. P. 222–3°); with benzophenone (with $ZnCl_2$) gives bis-diphenyl-methylene-*p*-phenylenediamine, gold-yellow plates (alc.), M. P. 180°; cond. prod. with succinic anhydride, colourless glittering needles, M. P. 262°.

Oxidation prod. (See *Ber.* **27**, 480; **37**, 2776, 2906.) Oxidised in presence of aniline or *o*-toluidine it yields blue indamines. Oxidised ($FeCl_3$) in presence of H_2S it yields Lauth's Violet. With alkaline hypochlorite quant. converted into insol. (white) benzoquinone dichlorimide.

1.2-Diaminobenzene-4-sulphonic Acid

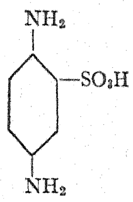


$C_6H_8N_2O_3S$; Mol. Wt. 188.17; (C, 38.3%; H, 4.3%; N, 14.9%; O, 25.5%; S, 17.0%).

Colourless cryst. which turn blue-green in air. Very difficultly soluble in cold H_2O, easily in boiling H_2O. Its solution is coloured an intense brown by lignin and red-brown by $FeCl_3$.

Forms salts with both bases and acids. Na salt cryst. with $1H_2O$. Hydrochloride, fine colourless, difficultly soluble needles. It is unstable, losing HCl on repeated cryst. from hot H_2O.

1.4-Diaminobenzene-2-sulphonic Acid



$C_6H_8N_2O_3S$; Mol. Wt. 188.17; (C, 38.3%; H, 4.3%; N, 14.9%; O, 25.5%; S, 17.0%).

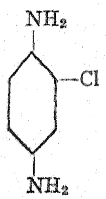
White needles ($+2H_2O$), which soon turn greenish in air. Moderately soluble in H_2O, nearly insoluble in alcohol, insoluble in ether and C_6H_6. Readily soluble in HCl.

Na Salt ($+4H_2O$), dense cryst., easily soluble.

Gives the indamine reaction in presence of *m*-toluylenediamine and neutral $FeCl_3$ and indophenol formation in presence of sodium-1-naphthol.

Oxidised with warm alkaline $K_3Fe(CN)_6$ it gives a chocolate coloured azoxy dye, soluble in hot H_2O with a red colour which dyes wool blue-green.

1.4-Diamino-2-chlorbenzene



$C_6H_7ClN_2$; Mol. Wt. 142.56; (C, 50.5%; H, 4.9%; Cl, 24.9%; N, 19.7%).

White needles (benzene-ligroin), M. P. 64°, readily soluble in H_2O.

Diacetyl deriv., white, satiny, glittering needles (toluene-alc.) M. P. 196–7° dibenzoyl deriv., white needles ($CHCl_3$), M. P. 228°.

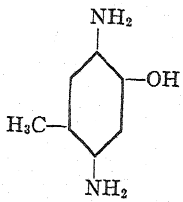
Hydrochloride, colourless needles; sulphate, faint rose-coloured needles only slightly soluble in H_2O; platinichloride and picrate, yellow needles.

The base gives monochlorquinone by acid oxidation with dichromate. With bleaching powder and conc. HCl it gives monochlorquinone

dichlor-diimide, faintly brownish-yellow needles, M. P. 83–4°, which give a violet dye with resorcinol and HOAc.

With H_2S and $FeCl_3$ it yields a violet red chlorthiazine dye, with aniline and dichromate a green-blue chlorindamine dye, and with phenol and dichromate a corresponding indophenol deriv.

2, 5-Diamino-4-cresol

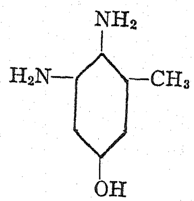


$C_7H_{10}N_2O$; Mol. Wt. 138.13; (C, 60.8%; H, 7.3%; N, 20.3%; O, 11.6%).

Does not appear to have been described in the literature. It may doubtless be distinguished from the foregoing diamine by treatment with alkaline α-naphthol solution, with which it would give the indophenol reaction (blue dye), whereas the *m*-diamine would not.

The methyl ether melts at 166° (decomp.). The ethyl ether melts at 108–9° and gives a monoacetyl deriv. which melts at 125°, and a diacetyl deriv. which melts at 165°.

3, 5-Diamino-2-cresol

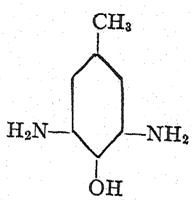


$C_7H_{10}N_2O$; Mol. Wt. 138.13; (C, 60.8%; H, 7.3%; N, 20.3%; O, 11.6%).

The free base is very unstable.

The hydrochloride cryst. in colourless needles; soluble in H_2O and alcohol but insoluble in ether.

3, 5-Diamino-4-cresol

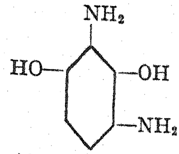


$C_7H_{10}N_2O$; Mol. Wt. 138.13; (C, 60.8%; H, 7.3%; N, 20.3%; O, 11.6%).

The phenol itself has not been described.

Its ethyl ether is a colourless oily liquid which distils undecomposed. The hydrochloride (of the ether) cryst. in white silky needles, very easily soluble in H_2O. It gives the chrysoidine reaction and other reactions characteristic of *m*-diamines. With $NaNO_2$ it gives a brown precipitate which dyes like Bismarck Brown. Heated with nitrosodimethylaniline in AcHO solution it gives a blue dye which is converted into a violet-red dye on long boiling.

2.4-Diamino-1.3-dihydroxybenzene (2, 4-diaminoresorcin)



$C_6H_8N_2O_2$; Mol. Wt. 140.11; (C, 51.4%; H, 5.8%; N, 20.0%; O, 22.8%).

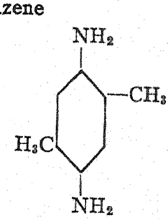
The free base turns brown in the air quickly. It gives a violet colour with NH_3 and a violet blue colour with $FeCl_3$, soon turning dirty brown. With aniline, alc. and AcHO in the cold it gives a green colour.

Hydrochloride, also relatively unstable. Suspended in $CHCl_3$ with a few drops of NaOH solution and shaken with H_2O, the latter becomes coloured cornflower-blue.

Sulphate (+1½HO), much more stable. May be precipitated from aqueous solution in cryst. form by the addition of excess H_2SO_4 or (better) by that of alc.

(The salts give the same reaction with $FeCl_3$ as the base.)

2, 5-Diamino-1, 4-dimethylbenzene



$C_8H_{12}N_2$; Mol. Wt. 135.14; (C, 71.1%; H, 8.2%; N, 20.7%).

Yellow needles, M. P. 149–50°. Slightly soluble in cold H_2O, readily in hot. Soluble in C_6H_6 and ether with difficulty.

Hydrochloride, leaflets, readily soluble in H_2O and hot alc. Sulphate, small cryst., almost insoluble in hot H_2O.

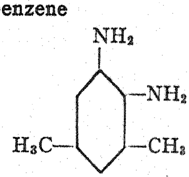
On oxidation it gives *p*-xyloquinone, M. P. 123.5–125.

With neutral or acid solutions of $FeCl_3$ it gives a green sol., turning yellow with excess $FeCl_3$.

With $K_2Cr_2O_7$ it gives a green precipitate, which turns violet-black on heating (odour of quinone).

With $NaNO_2$ in AcHO it gives a dark green solution which quickly turns yellow (odour of quinone on warming).

4, 5-Diamino-1, 3-dimethylbenzene



$C_8H_{12}N_2$; Mol. Wt. 135.14; (C, 71.1%; H, 8.2%; N, 20.7%).

Leaflets or fine needles, M. P. 77–8°. Readily soluble in alcohol and ether, somewhat so in hot H_2O, difficultly soluble in ligroin and cold C_6H_6. Coloured red by $FeCl_3$.

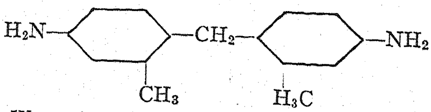
Hydrochloride, short, four-sided prisms, readily soluble in H_2O.

The 4-nitroso deriv. of the base cryst. in white leaflets, M. P. 81°. Its picrate, prisms, melts at 128°. The 4-nitroso-5-acetyl deriv., white leaflets, M. P. 135°.

On passing Cl through a solution of the base in acetic and hydrochloric acids tetrachlor-1, 2-dimethylcyclohexendion is formed in prisms which melt at 63°, solidify again at 64° and then melt at 130°.

With $K_2Cr_2O_7$ it gives a brown precipitate in the cold and a red solution smelling of quinone if warmed. With $NaNO_2$ in AcHO solution it gives a yellow solution and then a white precipitate.

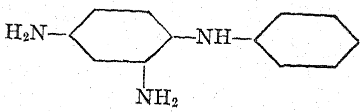
4, 4′-Diamino-2, 2′-dimethyldiphenyl-methane



$C_{15}H_{18}N_2$; Mol. Wt. 226.24; (C, 79.6%; H, 8.0%; N, 12.4%).

Crystallises from hot H_2O in colourless needles, M. P. 123°. The hydrochloride is readily soluble in H_2O but difficultly soluble in dil. HCl. Aqueous solutions of the hydrochloride are coloured deep violet by warming with $FeCl_3$.

2, 4-Diaminodiphenylamine



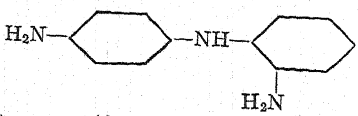
$C_{12}H_{13}N_3$; Mol. Wt. 199.19; (C, 72.3%; H, 6.6%; N, 21.1%).

Small light brown needles, M. P. 130°. Gives well cryst. diacid salts, less stable in air than the free base.

Diacetyl deriv., fine colourless needles, M. P. 188°.

The base yields an oxidation product ($C_{12}H_{10}N_2O$) on heating with MnO_2 and NH_3 which is insoluble in alkalies, cryst. from benzene in yellow-brown leaflets, M. P. 152°. By condens. with acenaphthenquinone 2-amino-phenylacenaphtho-phenazonium chloride may be obtained as dark violet needles, soluble in hot alcohol and H_2O with a Bordeaux-red colour and in H_2SO_4 with a red-brown colour, turning red on dilution. Its acetyl deriv. cryst. in long red needles, soluble in alcohol and H_2O, with an orange colour and a weak green fluorescence.

2, 4′-Diaminodiphenylamine



$C_{12}H_{13}N_3$; Mol. Wt. 199.19; (C, 72.3%; H, 6.6%; N, 21.1%).

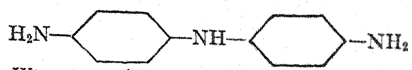
Colourless oil. The hydrochloride may be obtained by the action of HCl gas on the base, in a crude condition in the form of long prisms which soon turn dark (violet) in the air. With $FeCl_3$ it gives a green colour, turning purple.

The diacetyl deriv. cryst. in slightly reddish needles M. P. 203°.

By heating the diacetyl deriv. with HCl a pure hydrochloride is obtained which is stable in air and gives no colour test with $FeCl_3$. With $PtCl_4$ it forms a double salt, yellow needles.

By oxidation with dichromate an aminophenazine is obtained, dark brown cryst., which melts at 265–8° and may be sublimed.

4, 4′-Diaminodiphenylamine



$C_{12}H_{12}N_3$; Mol. Wt. 199.19; (C, 72.3%; H. 6.6%; N, 21.1%).

Leaflets (H_2O), M. P. 158°. Aqueous solutions are coloured intense green by $FeCl_3$

Sulphate, long needles, sparingly sol. in H_2O. Suspended in H_2O it gives the diazo sulphate with HNO_2, precipitated by alcohol and ether; with HCl and $PtCl_4$ it yields golden yellow hair-like needles of the double salt of the diazo chloride.

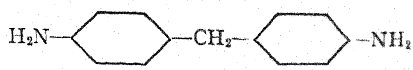
Monoacetyl deriv., leaflets which turn reddish gradually, M. P. 178°. Dissolved in HCl it gives an intense red-violet colour with $FeCl_3$ and a dark red-brown colour, turning brown and, finally, yellow with $NaNO_2$.

Diacetyl deriv., needles, M. P. 239°, readily soluble in alcohol and AcHO.

The amine gives an addition product with *m*-dinitrobenzene, violet cryst. (alc.) M. P. 91–2°.

Its salts are oxidised by dichromate with the formation of a blue indamine dye. Further oxidation in the presence of aniline yields phenosafranine, and in the presence of acetylphenylenediamine yields acetylaminosafranine (Abs. Max. 536 mu).

4, 4′-Diaminodiphenylmethane



$C_{13}H_{14}N_2$; Mol. Wt. 198.19; (C, 78.7%; H, 7.1%; N, 14.1%).

Silvery glittering leaflets (from H_2O) or dense cryst. (from C_6H_6). M. P. 92.5° (also reported variously between 86° and 89°). B. P. 257° at 18 mm. and 398–9° at 768 mm. Readily soluble in alcohol, ether and C_6H_6. Sparingly soluble in H_2O.

The hydrochloride and sulphate cryst. in leaflets, both readily soluble in H_2O, the latter sparingly soluble in alcohol.

Sulphone: Glittering leaflets, M. P. 217°, coloured intense blue by nitrous acid.

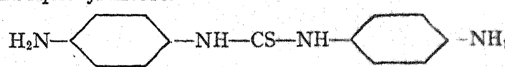
Diacetyl deriv.: glittering small plates, M. P. 228°, nearly insoluble in C_6H_6.

Dibenzylidine deriv. (with benzaldehyde), leaflets, M. P. 130°.

On oxidation with alk. $K_3Fe(CN_6)$ it yields a yellow-brown azoxy dye, M. P. 74–5°, which dyes wool and silk red.

With sym. trinitrobenzene it gives an addition product, dark brown flat prisms, M. P. 132.5°.

4, 4′-Diaminodiphenylthiourea

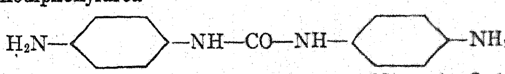


$C_{13}H_{14}N_4S$; Mol. Wt. 258.27; (C, 60.4%; H, 5.5%; N, 21.7%; S, 12.4%).

Colourless needles, M. P. 195°. Slightly soluble in hot H_2O and hot alcohol. Readily soluble in AcHO and dil. mineral acids. Gives insol. cryst. ppts. with picric acid and with sulphuric acid.

Treated with lead nitrate and alkali it yields lead sulphide.

4, 4′-Diaminodiphenylurea



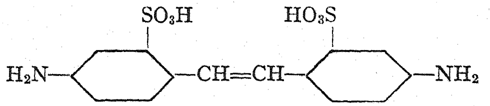
$C_{13}H_{14}N_4O$; Mol. Wt. 242.21; (C. 64.4%; H, 5.8%; N, 23.1%; O, 6.6%).

Silky needles or leaflets. Sublimes at 310° without melting. Difficultly soluble in cold H_2O, readily in hot H_2O. Only moderately soluble in cold alcohol.

Solutions of the hydrochloride darken in air and are coloured violet by $FeCl_3$. Gives a cryst. double salt with $SnCl_2$.

Diacetyl deriv., glittering scales, M. P. 344 (cor.), only very slightly soluble in boiling H_2O. On boiling with dil. HCl it yields the base.

4, 4′-Diamino-2.2′-disulpho-stilbene



$C_{14}H_{14}N_2O_6S_2$; Mol. Wt. 370.32; (C, 45.4%; H, 3.8%; N, 7.6%; O, 25.9%; S, 17.3%).

Microscopic yellow needles, insoluble in alcohol and ether and nearly insoluble in H_2O. Readily soluble in alkalies. It gives a microcryst. sparingly sol. tetrazo comp. which gives a violet dye with R-salt.

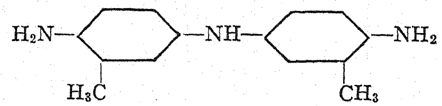
By deamination and alkaline fusion it may be converted into stilbene, M. P. 124°.

It yields *p*-amino-*o*-sulphobenzaldehyde on oxidation with (neutral) $KMnO_4$ which gives a deeply coloured hydrazone with phenylhydrazine.

On oxidation with alk. $K_3Fe(CN)_6$ it yields a red dye which dissolves in conc. H_2SO_4, with a dark blue colour, and gives a dark brown precipitate on dil.

The diacetyl deriv. (yellow cryst. powder, insoluble in H_2O) and its salts are phototropic. They turn purple-red in sunlight and return to their original light yellow colour in the dark.

4.4′-Diamino-3.3′-ditolylamine

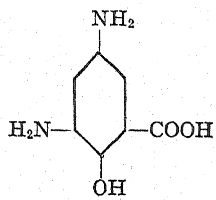


$C_{14}H_{17}N_3$; Mol. Wt. 227.23; (C, 74.0%; H, 7.5%; N, 18.5%).

Liquid. B. P. 312° (decomp.) at 727.5 mm.

If KNO_3 is added to a solution in H_2SO_4 it turns yellow, then green and finally red-brown. With KNO_3 the colour obtained is purple-red, then red-violet and finally blue-violet.

3, 5-Diamino-2-hydroxy Benzoic Acid (Diamino Salicylic Acid)



$C_7H_8N_2O_3$; Mol. Wt. 168.12; (C, 50.0%; H, 4.8%; N, 16.7%; O, 28.6%).

Small colourless star-clustered needles which turn dark quickly in air. Slightly soluble in cold H_2O, readily in hot. Gives brown-red colour with neutral $FeCl_3$ and eventually black flocks.

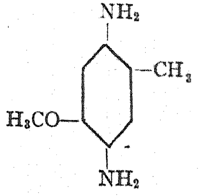
Hydrochloride, quadratic prisms, readily soluble in H_2O, difficultly in alcohol. Solutions are unstable to light. Hydriodide, yellow rhombic plates stable in presence of excess HI.

For dyes by tetrazotisation and coupling, see Friedlaender, III, 638, 639.

Dis-benzolazo-salicylic acid, red-brown needles, M. P. 218°, orange sol. in H_2SO_4, violet-red on dil. Gives acetyl deriv., M. P. 196°.

Distoluolazo-salicylic acid, glittering dark violet cryst., M. P. 170°. Gives acetyl deriv., M. P. 173°.

2, 5-Diamino-4-methoxy-toluene

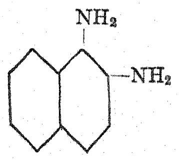


$C_8H_{12}N_2O$; Mol. Wt. 152.15; (C, 63.1%; H, 7.9%; N, 18.4%; O, 10.5%).

Colourless cryst., M. P. 166° (decomp.). Aqueous solutions soon coloured green in air.

It gives the indophenol reaction with alkaline solutions of beta-naphthol.

1, 2-Diaminonaphthalene



$C_{10}H_{10}N_2$; Mol. Wt. 158.15; (C, 75.9%; H, 6.4%; N, 17.7%).

Silver rhombic leaflets (H_2O), M. P. 95–6°. Readily soluble in alcohol, ether and $CHCl_3$. Readily oxidised.

The hydrochloride, prisms, readily soluble in H_2O, but only slightly soluble in HCl.

Diacetyl deriv., needles (alc.), M. P. 234°.

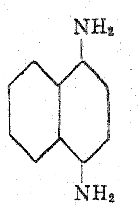
Benzoyl deriv., cryst. powder (AcHO), M. P. above 280°.

Dibenzoyl deriv., leaflets, M. P. 291°, difficultly soluble in alcohol and AcHO.

Fused with 2-oxydiphenylacetic acid lactone the diamine gives 2-(2′-oxy-benzhydryl-) naphthimidazole, colourless microsopic prisms, M. P. 294–5°, soluble in cold H_2SO_4 with a brown-green colour.

With phenanthrenequinone it gives naphthophenanthrazine, yellow, dissolves in H_2SO_4 with a dark-violet colour (yellow on dilution). The additive comp. with sym. trinitrobenzene cryst. from alcohol or C_6H_6 in deep purple needles, M. P. 203–4° (cor.).

1, 4-Diaminonaphthalene



$C_{10}H_{10}N_2$; Mol. Wt. 158.15; (C, 75.9%; H, 6.4%; N, 17.7%).

Very unstable, particularly in the moist state. M. P. 120°. With nitrous acid or chromic acid (heat) it gives alpha-naphthoquinone. With alkaline hypochlorite it gives an insoluble quinone dichloroimide. Gives a fluorescent green ether soluble when alkaline solutions are shaken with ether.

The sulphate is sparingly sol.

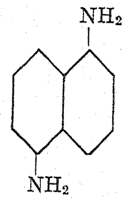
Acetyl deriv., the hydrochloride cryst. in long needles, the dichromate in orange yellow needles and the picrate in yellow needles, difficultly soluble in H_2O.

Diacetyl deriv., cryst. (AcHO), M. P. 303–4°, nearly insoluble in H_2O or ether, difficultly soluble in alcohol, readily soluble in hot AcHO.

Benzoyl deriv., needles, M. P. 186°, difficultly soluble in hot H_2O, readily soluble in alcohol.

It gives an addition product with sym. trinitrobenzene, M. P. 218° (decomp.), black needles (C_6H_6).

1, 5-Diaminonaphthalene



$C_{10}H_{10}N_2$; Mol. Wt. 158.15; (C, 75.9%; H, 6.4%; N, 17.7%).

Colourless prisms (ether), M. P. 189.5°. Sublimes almost without decomp. Easily soluble in ether and $CHCl_3$, mod. sol. in hot H_2O, almost insoluble in cold H_2O. Suspended in H_2O the free base gives a blue-violet colour with $FeCl_3$ and after some time a blue-violet precipitate. The dil. alc. sol. is coloured blue, turning violet-blue, with a drop of isoamyl nitrite and a little acid. Does not give naphthoquinone on warming with chromic acid.

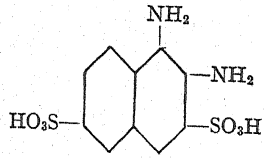
Sulphate, fine needles, nearly insoluble in dil. H_2SO_4, alcohol and ether.

The acetyl deriv., greenish-white granules, does not melt under 360°. It apparently causes marked itching.

Additive comp. with: *m*-dinitrobenzene, brown black cryst. (alc.), M. P. 78–9°; sym. trinitrobenzene deep brown needles (alc.), M. P. 245° (cor.); 1, 3, 5-trinitronaphthalene, black needles (alc. and C_6H_6), M. P. 243° (decomp.).

If the base is diazotised and boiled with cuprous chloride in HCl it gives 1, 5-dichlornaphthalene, M. P. 106–7°

1, 2-Diaminonaphthalene-3, 6-disulphonic Acid



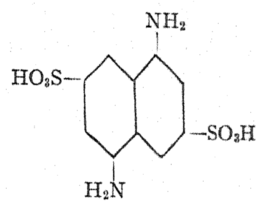
$C_{10}H_{10}N_2O_6S_2$; Mol. Wt. 318.27%; (C, 37.7%; H, 3.2%; N, 8.8%; O, 30.2 %; S, 20.1%).

Readily soluble in hot H_2O, precipitated by HCl as granular cryst. and by NaCl as fine pointed needles. Coloured emerald-green by $FeCl_3$. It gives no reaction with *p*-nitrodiazobenzol in acid solution, and is decomposed by HNO_2 with evolution of nitrogen. With mineral acids it yields dihydroxynaphthalene disulphonic acid.

With phenanthrenequinone it yields a citron-yellow phenanthro-naphthazine dye which dissolves in H_2SO_4 with a bluish fuchsin-red colour, turning yellow and then orange on dil. On alk. fusion this yields a eurhodole dye, insoluble in H_2O, which dissolves in H_2SO_4 with a deep green-blue colour, turning violet and then Bordeaux red on dil. and finally yielding a yellow-brown floc. precipitate.

The acid Na salt of the amino acid cryst. in needles and fluoresces green in the absence of mineral acids. The acid Ca and Ba salts cryst. in small oblique prisms and are sparingly sol.

1, 5-Diaminonaphthalene-3, 7-disulphonic Acid

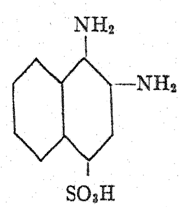


$C_{10}H_{10}N_2O_6S_2$; Mol. Wt. 318.27; (C, 37.7%; H, 3.2%; N, 8.8%; O, 30.2%; S, 20.1%).

Very sparingly soluble microscopic cryst. or leaflets. Unaltered by mineral acids. Alk. fusion yields, 4,8-diamino-2-naphthol-6-sulphonic acid. With *p*-nitrodiazobenzol in acid solution it gives a red solution. It gives a sparingly soluble clear yellow tetrazo comp.

Na salt, needles, sol, in 21 parts H_2O at 15°.

1, 2-Diaminonaphthalene-4-sulphonic Acid (Amino Naphthionic Acid)



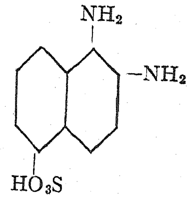
$C_{10}H_{10}N_2O_3S$; Mol. Wt. 238.21; (C, 50.4%; H, 4.2%; N, 11.8%; O, 20.2%; S, 13.5%).

Small needles, sp. sol. in H_2O. The ammon. sol. is oxidised only very slowly in air, becoming pale green-brown, turned pink by HCl. With traces of $FeCl_3$ it gives a dirty green colour, quickly turning brown-black; with excess $FeCl_3$ a dull green colour and on warming a grass-green colour and a green precipitate. On treatment with Na amalgam it yields 1, 2-naphthalenediamine.

If a boiling solution acidified with AcOH is treated with an equiv. sol. of phenanthraquinone in $NaHSO_3$ sol. with excess AcONa a quinoxaline sulphonic acid is obtained in fine lemon-yellow needles which dissolve in H_2SO_4 with a blue-violet colour. Fused with KOH this gives a eurhodol dye which dissolves in H_2SO_4 with an indigo-blue colour and gives at once a carmine-red cryst. precipitate on dil.

The acetyl deriv. (of amino-naphthionic acid) is readily sol. and is converted into ethenylnaphthalene diamino-sulphonic acid by mineral acids or heat.

1, 2-Diaminonaphthalene-5-sulphonic Acid

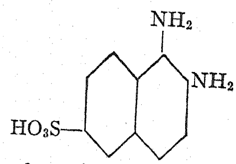


$C_{10}H_{10}N_2O_3S$; Mol. Wt. 238.21; (C, 50.4%; H, 4.2%; N, 11.8%; O, 20.2%; S, 13.5%).

Glittering brown leaflets, difficultly soluble in H_2O. Alk. sols. turn brown slowly. It gives an emerald-green colour with $FeCl_3$ and a dark green precipitate on long standing. It reduces $AgNO_3$. It gives 1,2-naphthalene diamine by treatment with Na amalgam in presence of SO_2.

With phenanthraquinone it gives an azine dye which dissolves in H_2SO_4 with a violet colour becoming orange on dilution. The corresponding eurhodol, obtained by fusion with KOH, is an orange-yellow dye, soluble in H_2SO_4 with a dark violet colour which turns cherry-red on dil. and then gives a dirty red precipitate.

1, 2-Diaminonaphthalene-6-sulphonic Acid (Amino Broenner Acid)



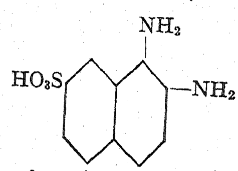
$C_{10}H_{10}N_2O_3S$; Mol. Wt. 238.21; (C, 50.4%; H, 4.2%; N, 11.8%; O, 20.2%; S, 13.5%).

Long rectangular plates or fine pointed needles, very difficultly soluble in H_2O. An ammon. solution on filter paper is slowly coloured brown-pink which turns red and is then slowly decol. by HCl. With $FeCl_3$ it is described variously as giving a yellow colour and a dirty green precipitate.

With phenanthraquinone it gives a citron-yellow quinozaline sulphonate which dissolves in H_2SO_4 with a red-violet colour. Fused with KOH this yields a euhrodol which dissolves in H_2SO_4 with a pure ultramarine blue colour and slowly deposits a cherry-red precipitate on dil.

The Na salt is precipitated by excess NaOH in silvery glittering scales.

1, 2-Diaminonaphthalene-7-sulphonic Acid (Amino-F-acid)



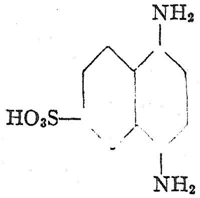
$C_{10}H_{10}N_2O_3S$; Mol. Wt. 238.21; (C, 50.4%; H, 4.2%; N, 11.8%; O, 20.2%; S, 13.5%).

Somewhat more sol. than amino Bronner acid, but very similar in general characteristics.

Excess NaOH, however, does not precipitate a cryst.

Na salt and the eurhodol dye, which may be obtained from the amino acid, dissolves in H_2SO_4 with a violet colour and gives a brown-red precipitate on dil.

1, 4-Diaminonaphthalene-6-sulphonic Acid (Amino. Cleve's Acid)

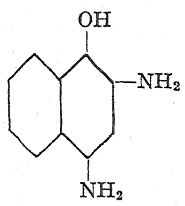


$C_{10}H_{10}N_2O_3S$; Mol. Wt. 238.21; (C, 50.4%; H, 4.2%; N, 11.8%; O, 20.2%; S, 13.5%).

Silvery needles or cryst. powder. The acid is very sparingly sol. in H_2O, but its salts with alkalies and alkaline earths are readily soluble. With HNO_2 or $FeCl_3$ it gives naphthoquinone.

Mono-acetyl deriv., small colourless needles, is also very sparingly. sol. in H_2O but gives soluble salts with alkalies and alkaline earths. With $FeCl_3$ it gives a brilliant blue colour turning brown on long standing or heating. It may be diazotised without decomp., yielding a yellow sparingly sol. diazo comp. It may be converted into 1, 4-naphthalene-diamine and into 1-naphthylamine-7-sulphonic acid.

2, 4-Diamino-1-naphthol



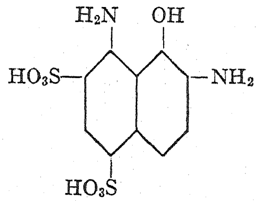
$C_{10}H_{10}N_2O$; Mol. Wt. 174.15; (C, 68.9%; H, 5.8%; N, 16.1%; O, 9.2%).

Hydrochloride, microscopic leaflets. The dry salt is moderately stable but the moist salt oxidised rapidly in air, giving diiminonaphthol. With $SnCl_2$ it forms a double salt, monoclinic prisms, insoluble in conc. HCl, readily soluble in alcohol.

Triacetyl deriv., microscopic needles (AcHO), M. P. 280° (decomp.), difficultly soluble in hot alcohol.

With nitrous acid or alkyl nitrites the diaminophenol is oxidised to 2-amino-1, 4-naphthaquinoneimide.

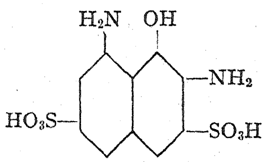
1.7-Diamino-8-naphthol-2.4-disulphonic Acid



$C_{10}H_{10}N_2O_7S_2$; Mol. Wt. 334.27; (C, 35.9%; H, 3.0%; N, 8.4%; O, 33.5%; S, 19.2%).

Readily soluble in H_2O. The ammon. solution on filter paper behaves like that of 2-amino-H-acid. The reaction with $FeCl_3$ is also the same. The AcONa solution on filter paper becomes dull green in air, subsequently turning pink. The green colour gives a gray-blue spot with HCl.

1.7-Diamino-8-naphthol-3, 6-disulphonic Acid (7-amino-H-acid)



$C_{10}H_{10}N_2O_7S_2$; Mol. Wt. 334.27; (C, 35.9%; H, 3.0%; N, 8.4%; O, 33.5%; S, 19.2%).

Readily soluble in H_2O. The ammon. solution on filter paper turns bright orange in air and gives a blue spot with HCl quickly becoming more violet with a magenta rim. The aqueous solution is turned Bordeaux red (or blue-violet turning magenta) by $FeCl_3$, and yellow-red by bleaching powder soluble. It is not diazotised in acid solution. With phenanthrenequinone it gives a yellow dye, soluble in Na_2CO_3 soluble from which it may be salted out, which dissolves in H_2SO_4 with a corn-flower-blue colour.

Hesse employs the following tests in distinguishing between the various amino derivs. of H-acid:

(1) Boil with a few drops of 40% NaOH and dil. with 1 c.c. H_2O.

(2) Warm with 2 or 3 drops conc. H_2SO_4 until it begins to turn violet, add 1 or 2 drops .5% $NaNO_2$ sol., cool, dil. with .5 c.c. H_2O, nearly neutralise with 40% NaOH and make alk. with excess of sat. Na_2CO_3 sol.

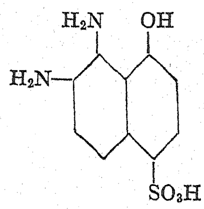
(3) Dissolve in 1 drop sat. Na_2CO_3 sol., add 1 drop conc. HCl, dil. with 0.5 c.c. H_2O, heat to boiling and cool. Place drop on filter paper and add 10 or 2 drops H_2O_2 sol.

(3a) When maximum colour has developed in test 3 add drop 40% NaOH solution.

The colour reactions of 7-amino-H-acid in these tests are: (1) yellow or brown, (2) blue-red, (3) brown or yellow, and (3a) red.

It has been reported as suitable for application as a photographic developer.

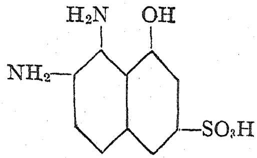
1.2-Diamino-8-naphthol-5-sulphonic Acid



$C_{10}H_{10}N_2O_4S$; Mol. Wt. 254.21; (C, 47.2%; H, 4.0%; N, 11.0%; O, 25.2%; S, 12.6%).

It gives a phenanthronaphthazine dye by condensation with phenanthrenequinone which is sparingly sol. in hot as well as cold H_2O but is mod. sol. in cold dil. alkalies and readily soluble in hot alk. sols. It dyes wool yellow and dissolves in H_2SO_4, with a blue colour.

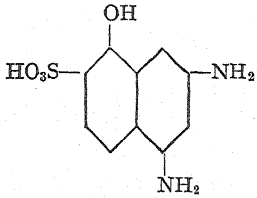
1.2-Diamino-8-naphthol-6-sulphonic Acid



$C_{10}H_{10}N_2O_4S$; Mol. Wt. 254.21; (C, 47.2%; H, 4.0%; N, 11.0%; O, 25.2%; S, 12.6%).

Sparingly sol. in H_2O. Heated with an aq. suspension of phenanthrenequinone it yields a cryst. phenanthronaphthazine dye, very sl. sol. in cold H_2O, more readily sol. in hot H_2O, with a yellow colour, and also sol. in hot alkalies. It dyes wool yellow and dissolves in H_2SO_4 with a green-blue colour.

2, 4-Diamino-1-naphthol-7-sulphonic Acid



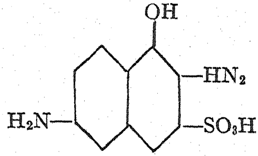
$C_{10}H_{10}N_2O_4S$; Mol. Wt. 254.21; (C, 47.2%; H, 4.0%; N, 11.0%; O, 25.2%; S, 12.6%).

The hydrochloride cryst. in long rhombic plates which turn reddish in air quickly. Mod. sol. in H_2O but insoluble in alcohol. With $FeCl_3$ it gives a precipitate of the diiminonaphthol sulphonic acid, copper-red micro. needles, insoluble in cold H_2O and soluble in hot H_2O with partial decomp. In alkalies it dissolves with a yellow colour and is then precipitated by acids.

It gives a triacetyl deriv. of which the Ba salt ($+3\frac{1}{2}H_2O$) forms long white star-grouped cryst. difficultly soluble in H_2O. With $FeCl_3$ the solution turns brown and is then quickly decol. with a deposit of yellow cryst.

The diaminonaphthol sulphonic acid forms a tin salt which cryst. in leaflets and is stable in dry condition, but readily oxidised by the air if moist. The acid gives no dyes with diazo comps. and is decomp. by HNO_2.

2, 6-Diamino-5-naphthol-7-sulfonic Acid (Amino-J-acid)



$C_{10}H_{10}N_2O_4S$; Mol. Wt. 254.21; (C, 47.2%; H, 4.0%; N, 11.0%; O, 25.2%; S, 12.6%).

Sparingly sol. in H_2O. Hot aqueous solutions have a blue fluorescence, and dil. alk. sols. a bright green fluorescence.

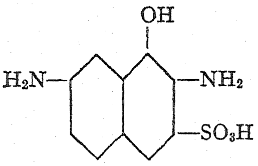
An ammon. sol. on filter paper turns green-yellow, soon turning brown, and gives a green spot with HCl which almost immediately becomes pink with a green rim. If $FeCl_3$ sol. is added to a very dil. aq. suspension of the

acid it gives a dull green colour which quickly turns dull violet, then blue-red and finally brown-red.

In aq. suspension the acid can be diazotised and coupled with β-naphthol.

The triacetyl deriv. of the unsulphonated diaminophenol melts at 261° (decomp.).

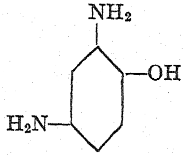
2, 7-Diamino-8-naphthol-6-sulphonic Acid



$C_{10}H_{10}N_2O_4S$; Mol. Wt. 254.21; (C, 47.2%; H, 4.0%; N, 11.0%; O, 25.2%; S, 12.6%).

Small yellowish cryst. or clear brownish leaflets (from AcONa sol;). Nearly insoluble in cold H_2O and only slightly soluble in hot H_2O. It dissolves readily in alkalies and alk. solutions are readily oxidised in air. An ammon. sol. on filter paper rapidly turns brown and gives a dull violet spot with conc. HCl. With $FeCl_3$ it gives a blue colour (or a green colour rapidly turning violet) and with bleaching powder solution a Bordeaux-red colour. With HNO_2 it gives a yellow-brown (or deep brown) solution with evolution of nitrogen.

1.5-Diamino-2-phenol



$C_6H_8N_2O$; Mol. Wt. 124.11; (C, 58.0%; H, 6.5%; N, 22.6%; O, 12.9%).

Free base, white leaflets, M. P. 78–80° (decomp.). Very unstable, turning brownish black in air quickly. Aqueous solutions of the base are coloured intense blue by NaOH.

Aqueous solutions of the salts cryst. well but soon turn brown. With $FeCl_3$ + dichromate they give aminoquinonimide-dichromate, green-black glittering grains, sol. in cold H_2O with red colour; with $FeCl_3$ + picric acid the corresponding picrate, chocolate-brown cryst., soluble in H_2O with a blood-red colour.

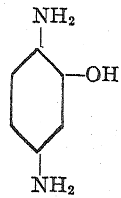
Hydrochloride, needles. Sulphate ($+2H_2O$), rhomb. plates.

Oxalate, sol. in 2,000 parts cold, 33 parts hot water.

Picrate, citron-yellow needles, M. P. about 120° (decomp.), sol. in 33 parts H_2O at 15°.

Diacetyl deriv., needles (H_2O), M. P. 220–2°, soluble in alcohol, AcHO and boiling H_2O; triacetyl deriv., M. P. 180–2°, gives the diacetyl deriv. with cold dil. NaOH; dibenzoyl deriv., reddish leaflets (alc.), M. P. 185–188° (Stuckenberg, *Ann.* **205**, 71), small gray scales (alc.), M. P. 253–4° (Meldola and Hollely, *J. Chem. Soc.*, **101**, 931); tribenzoyl derivs., $C_6H_3OH.(N\text{-}[COC_6H_5]_2)$. $(NHCOC_6H_5)$ rhomb plates, M. P. 231–3°, insoluble in H_2O and alc. sl. sol. in AcOH, readily sol. in warm alc.; $C_6H_3.(OCOC_6H_5)$: $(NHCOC_6H_5)_2$, white microcryst. (AcHO) M. P. 240–2°.

2, 5-Diaminophenol



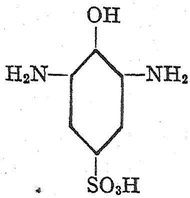
$C_6H_8N_2O$; Mol. Wt. 124.11; (C, 58.0%; H, 6.5%; N, 22.6%; O, 12.9%).

Hydrochloride, long colourless needles, readily soluble in H_2O, slightly soluble in HCl. The aqueous solution soon becomes coloured violet in the air.

Diacetyl deriv., glittering needles, readily turning brown, M. P. 265°. Nearly insoluble in cold H_2O, somewhat soluble in boiling H_2O, readily soluble in alcohol, AcHO or cold dil. alkalies.

Triacetyl deriv., colourless lustrous leaflets (H_2O), M. P. 234°. Nearly insoluble in cold H_2O, readily soluble in alcohol, AcHO or hot H_2O. Dissolves slowly in dil. NaOH with the loss of one acetyl group.

2, 6-Diaminophenol-4-sulphonic Acid



$C_6H_8N_2O_4S$; Mol. Wt. 204.17; (C, 35.3%; H, 4.0%; N, 13.7%; O, 31.3%; S, 15.7%).

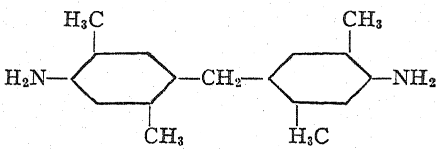
White cryst. which gradually darken in air.

Its solutions are coloured deep brown by oxidising agents.

Readily diazotised, giving a very stable, readily soluble, deep yellow tetrazo deriv. which forms a blue-black dye with β-naphthol, violet in aqueous solution, turned red by mineral acids.

The characteristics of a considerable number of disazo dyes, obtained by coupling with two different components, are given in D. R. P. 148,212 (Friedl. VII, 393).

4, 4′-Diamino-2, 5, 2′, 5′-tetramethyldiphenylmethane (diaminodixylylmethane)

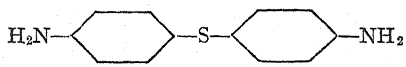


$C_{17}H_{22}N_2$; Mol. Wt. 254.28; (C, 80.3%; H, 8.7%; N, 11.0%).

Colourless glittering needles (alc.), M. P. 144° (also reported as 138–9°). Readily soluble in alcohol and ether, insoluble in H_2O. The aqueous solution of the hydrochloride is coloured deep violet by warming with $FeCl_3$.

Boiled with dil. HCl and nitrite it yields the corresponding dihydroxy deriv., M. P. 181°. The latter substance on bromination yields a di-bromo deriv., M. P. 152°.

4, 4′-Diaminothiodiphenyl (Thioaniline)



$C_{12}H_{12}N_2S$; Mol. Wt. 216.23; (C, 66.6%; H, 5.6%; N, 13.0%; S, 14.8%).

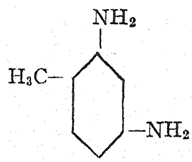
Long thin needles, M. P. 105–8°. Slightly soluble in hot H_2O, but nearly insoluble in cold H_2O. Readily soluble in alcohol, ether and benzene.

Hydrochloride ($+2H_2O$), long prisms, readily soluble in H_2O, but nearly insoluble in org. solvents. Sulphate ($+H_2O$), needles or prisms, only slightly soluble in cold H_2O.

Diacetyl deriv., fine needles (alc.), M. P. 214–6°, readily sol. in hot alcohol, nearly insoluble in H_2O.

Thioaniline yields sulphuric and picric acids on warming with nitric acid. With ethyl nitrite it yields phenylsulphide. Warmed with H_2SO_4 it becomes coloured blue-violet, turning red on dil. Its salts give a violet alc.-sol. precipitate with dichromate.

2.4-Diaminotoluene (*m*-tolylenediamine)



$C_7H_{10}N_2$; Mol. Wt. 122.13; (C, 68.8%; H, 8.3%; N, 22.9%).

Long needles or rhombic prisms. Readily sol. in alcohol, ether or hot H_2O. M. P. 99°. B. P. 280°.

Sulphate ($+2H_2O$), long monocl. prisms, 100 pts. H_2O at 19.5° dissolve 5.58 pts. salt.

2-Acetyl deriv., white needles (alc.), M. P. 140°, sol. in alcohol, ether or hot H_2O, gives a difficultly sol. salt (yellow needles) with platinic chloride.

2-Chloracetyl deriv., M. P. 230–1° (decomp.).

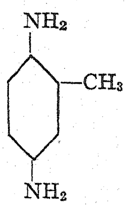
4-Acetyl deriv., long needles (H_2O), M. P. 161–2°; hydrochloride, needles, M. P. 263–4°. By oxidising the acetyl comp. with Caro's acid the 2-nitroso deriv. is obtained, pale yellow-brown cryst. (alc.), M. P. 195°, sol. in AcHO but insol. in C_6H_6 or H_2O.

Diacetyl deriv., white, lustrous needles (H_2O), M. P. 224°.

Dibenzoyl deriv., plates (AcHO), M. P. 224°, difficultly soluble in alcohol.

Gives a red-brown colour with nitrous acid. With Na_2O_2 it gives *p*-nitro-*o*-toluidine at moderate temp. and 2, 4-dinitrophenol at boiling temperature. The condensation product with dinitrochlorbenzene (red plates) melts at 184°; acetyl deriv., M. P. 163–4°.

2.5-Diaminotoluene (*p*-tolylenediamine)



$C_7H_{10}N_2$; Mol. Wt. 122.13; (C, 68.8%; H, 8.3%; N, 22.9%).

Leaflets or colourless plates, M. P. 64°, B. P. 274°. Readily soluble in H_2O, alcohol, ether and hot C_6H_6, difficultly soluble in cold C_6H_6.

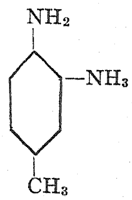
Sulphate, 100 pts, H_2O at 11.5° dissolve 0.84 pts. salt.

5-Acetyl deriv., oxidised with Caro's acid gives 5-acetylamino-*o*-toluidine, green needles (alc.), M. P. 128–9°, sparingly sol. in ether, readily sol. in AcHO.

Diacetyl deriv., pale brown cryst. M. P. 220°; oxidised with $KMnO_4$ gives 2, 5-diacetylaminobenzoic acid, colourless cryst. (Alc.), M. P. 262° (decomp.); with acetic anhydride gives 5-acetaminoacetanthranil, M. P. 253° (cor.).

Oxidised in presence of aniline or *o*-toluidine it gives blue-green indamines which are converted into safranines on boiling.

3, 4-Diaminotoluene



$C_7H_{10}N_2$; Mol. Wt. 122.13; (C, 68.8%; H, 8.3%; N, 22.9%).

Nearly colourless plates or needles (light petroleum), M. P. 88.5°, B. P. 265°. Moderately soluble in cold H_2O, the solution soon turning dark in air.

3-Acetyl deriv., M. P. 95°, (anhydro base, M. P. 145–50°); gives a diazoimide with nitrous acid, pale yellow monocl. cryst., M. P. 93–4°.

4-Acetyl deriv., M. P. 110–2°, (anhydro base, M. P. 203°); gives a diazoimide with nitrous acid, M. P. 120°, volatile with steam.

Diacetyl deriv., long prisms, M. P. 210°.

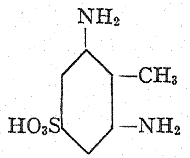
3-Benzoyl deriv., colourless needles (C_6H_6), M. P. 158°; gives a diazoimide, long colourless needles, M. P. 122–3°.

4-Benzoyl deriv., colourless lustrous needles (alc. or C_6H_6) M. P. 193–4°; gives a diazoimide with nitrous acid, colourless needles, M. P. 127–8°.

Dibenzoyl deriv., M. P. 263–4°.

With phenanthrene-quinone it forms quinoxaline deriv., faint yellow needles (alc.), M. P. 204°, soluble in H_2SO_4 with yellow-red colour.

2, 6-Diaminotoluol-4-sulphonic Acid



$C_7H_{10}N_2O_3S$; Mol. Wt. 209.19; (C, 41.6%; H, 5.0%; N, 13.9%; O, 23.7%; S, 15.9%).

White rhombic prisms which turn gray easily in air and do not melt up to 280°. Sol. in 1,470 pts. H_2O at 14°, insol. in alcohol.

Hydrochloride ($+2H_2O$), small, colourless rhombic prisms which are readily sol. in H_2O (with partial loss of acid).

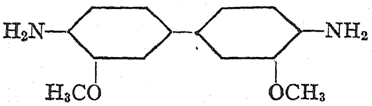
The hydrochloride gives a tetrazo comp. with nitrite solutions when cooled with ice, but forms an analogue of Bismarck Brown at ordinary temps.

Two mol. of the acid coupled with diazotised *o*-tolidine give an orange dye which turns violet with dilute acids.

The diazo comp. of the monobrom deriv. of the acid cryst. in thin, pale yellow, long plates ($+2\frac{1}{2}H_2O$), almost insol. in alcohol, easily sol. in H_2O, coloured dark blue by heating over 100°.

(For azo deriv. see Friedl. II, 369; III, 741; IV, 992.)

Dianisidine



$C_{14}H_{16}N_2O_2$; Mol. Wt. 244.21; (C, 68.8%; H, 6.6%; N, 11.5%; O, 13.1%).

Colourless leaflets which become coloured violet soon in air. M. P. 131–2° (also reported as 137°). Sol. in 24 pts. boiling H_2O and 90 pts. H_2O at 20°. Readily sol. in organic solvents or dil. mineral acids.

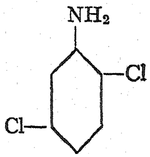
Hydrochloride, prisms, readily sol. but yields a sparingly sol. basic salt on boiling in H_2O; sulphate, needles, sol. in about 21 pts. boiling H_2O but nearly insoluble in cold H_2O; benzene sulphonate, M. P. 277°, sol. in 47.4pts. H_2O at 18°; α-naphthalene-sulphonate, M. P. 272°, sol. in 357 pts. H_2O to 15°; β-naphthalene-sulphonate, M. P. 290°, sol. in 1,000 parts H_2O at 15°; 2, 7-naphthalene disulphonate, M. P. 318°, very sp. sol.

Acetyl deriv., white nodules (+H O) from water, melts at 67°, loses its H_2O at 100° and then the anhydrous comp. melts at 116°; diacetyl deriv., colourless prisms, M. P. 231°, insol. in H_2O or ether sp. sol. in alcohol mod. sol. in AcHO or acetone; dibenzoyl deriv., colourless prisms, M. P. 236°, insoluble in H_2O and only sparingly sol. in alcohol.

Additive comp. with: Sym. trinitrobenzene flat black needles, M. P. 144°; 1, 3, 6, 8-tetranitrobenzene, black powder, M. P. 205°.

Diazotised and coupled with: β-naphthol, dark plates with green reflex (toluene), M. P. 310°, green-blue solution in H_2SO_4, violet precipitate on dil.; Naphthol AS, dark violet cryst., powder (toluene), M. P. 320°, green-blue solution in H_2SO_4, blue-violet precipitate on dil.

2, 5-Dichloraniline



$C_6H_5Cl_2N$; Mol. Wt. 162; (C, 44.5 %; H, 3.1 %; Cl, 43.8 %; N, 8.6 %). Long, thick needles (ligroin), M. P. 50°, B. P. 251° (246° at 744 m.m.).

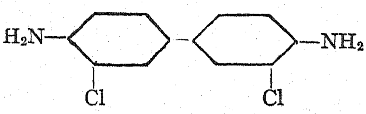
Monoacetyl deriv., M. P. 132°.

Diacetyl deriv., plates (alc.), M. P. 91–2°.

Hydrochloride, colourless needles, M. P. 191–2°; sulphate, glittering scales, M. P. 196–7°.

Diazotised and coupled with β-naphthol: fine orange-red needles (HOAc), M. P. 184°.

3.3′-Dichlor-benzidine



$C_{12}H_{10}Cl_2N_2$; Mol. Wt. 253.08; (C, 56.9%; H, 4.0%; Cl, 28.0%; N, 11.1%).

Clear brown needles (alc.), nearly insoluble in H_2O. M. P. 132–3°.

The hydrochloride, needles, is sparingly sol. in H_2O. Its solutions are coloured green by oxidising agents. The sulphate, nitrate and oxalate are only very slightly soluble in boiling H_2O.

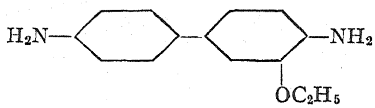
Diazotised and boiled it yields an amorphous red-brown infusible powder, insoluble in ordinary solvents, which gives yellow addition products with HI or with acetic anhydride.

Monoacetyl deriv., white feathery needles, M. P. 104–5°, sparingly soluble in H_2O, readily soluble in alcohol. Diacetyl deriv., white needles (AcHO), M. P. 302°, insoluble in H_2O.

Dibenzoyl deriv., white tufted needles, M. P. 265°.

The 2, 6-naphthalenedisulphonate and 2, 7-naphthalene-disulphonate are sol., respectively, in 1,430 and 1,250 parts H_2O at 15°. Both salts melt above 360°.

3-Ethoxybenzidine



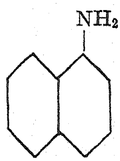
$C_{14}H_{16}N_2O$; Mol. Wt. 228.21; (C, 73.6%; H, 7.1%; N, 12.3%; O, 7.0%).

Glittering flat needles, M. P. 139° (also reported as 135°). Sparingly soluble in H_2O or ether, but readily soluble in hot alcohol. The sulphate forms colourless prisms, sparingly soluble in H_2O, but readily soluble in HCl with the formation of the hydrochloride.

4′-Acetyl deriv., small white leaflets (H_2O), M. P. 137–8°, insoluble in ether, but soluble in hot H_2O or in alcohol; diacetyl deriv., small white needles (alc. or AcHO), M. P. 240°, insol. in H_2O.

The ether is converted into the corresponding phenol, M. P. 185°, by heating with HCl under pressure.

1-Naphthylamine



$C_{10}H_9N$; Mol. Wt. 143.13; (C, 83.9%; H, 603 %; N, 9.8%).

Flat, colourless, rhombic needles or plates with a disagreeable odour. M. P. 50°, B. P. 300°. D = 1.223 at 25°. Soluble in 590 parts H_2O at 15°. Volatile with steam. Coloured blue by $FeCl_3$. An alc. sol. is coloured yellow by HNO_2, turning red with HCl (distinction from β-naphthylamine).

Monoacetyl deriv., feathery needles, M. P. 159°; diacetyl deriv. sl. opaque, colourless cryst., M. P. 130°.

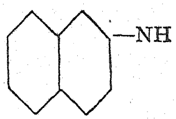
Salts: benzene sulphonate, M. P. 234°; picrate, green-yellow prisms (alc.), M. P. 161° (decomp.); sym. trinitrobenzoate, red needles (H_2O), M. P. 197° (decomp.); 2, 4, 6-tribrom-3-aminobenzoate, colourless cryst. (alc.) M. P 206°; *m*-nitrobenzoate, colourless, silky needles (C_6H_6), M. P. 105–6°; α-naphthalene sulphonate, M. P. 229°; β-naphthalene sulphonate, M. P. 240°; 2, 6-naphthalene disulphonate, M. P. >360°; 2, 7-naphthalene disulphonate, M. P. 305–9°; anthraquinone-2-sulphonate, M. P. 253°; H-acid salt, light violet-gray prisms, M. P. 278° (decomp.). (For data on the solubilities and optical properties of these and other salts see *J. Chem. Soc.*, **75**, 580; *J. Soc. Chem. Ind.*, **43**, 165, 299, 341; *Ind. Eng. Chem.*, **12**, 1081, 1085, 1194; **14**, 317.)

Additive comp. with: *m*-dinitrobenzene, M. P. 67°; sym. trinitrobenzene, brick-red prisms, M. P. 214° (acetyl deriv., long yellow needles, M. P. 140.5°); dinitrotoluene, M. P. 60°; trinitrotoluene, dark red prism. needles (alc.), M. P. 141.5°; sym. ethyl trinitrobenzene, wine-red leaflets (alc.), M. P. 72–3°; ethyl trinitrobenzoate, prune needles, M. P. 135–6°; 4, 6-dichlor-1, 3-dinitrobenzene, brown-red needles, M. P. 95°; 2, 4-dichlor-1, 3, 5-trinitrobenzene, brown-red needles M. P. 126–7°; sym. trichlortrinitrobenzene, flat dark brown plates (C_6H_6), M. P. 149–50°; hexanitroazobenzene, violet scales, M. P. 154° (decomp.); tetryl, black prisms (C_6H_6), M. P. 94°; picryl chloride, long brown needles (alc.), M. P. 111°; picramide, deep purple prism. needles, M. P. 203°; methyl picrate, small dark red needles, M. P. 75°; ethyl picrate, flat brick-red cryst., M. P. 79–5°; picraniline, brown-red cryst., M. P. 87°; 1, 3, 5-trinitronaphthalene, purple-black needles (alc.), M. P. 135.5°; 1, 3, 8-isomer, crimson needles (C_6H_6), M. P. 145–51°; 1, 4, 5-isomer, red needles, M. P. 67–8°; 1, 3, 5, 7-tetranitronaphthalene, black needles (AcHO), M. P. 220° (decomp.); 1, 3, 5, 8-isomer, black needles (C_6H_6), M. P. 162° (decomp.) 1, 3, 6, 8-isomer, purple needles (C_6H_6), M. P. 204–5°.

Condensation product with: *p*-brombenzenesulphonyl chloride, cryst., M. P. 183°; *m*-nitrobenzenesulphonyl chloride, cryst., M. P. 166.5°; sym. trinitrobenzaldehyde, orange, M. P. 242°; 3, 4, 6-trinitrotoluene, dark brown, M. P. 182°; 1-halogen-2-naphthol, M. P. 171°; picrylaniline, M. P. 197–8°; 4, 6-dichlor-1, 3-dinitrobenzene, red prisms which turn yellow at 180° and melt at 202–3°.

Diazotised and coupled with: *β*-naphthol, bronze plates with green reflex (toluene), M. P. 224°, deep blue solution in H_2SO_4, red-brown precipitate on dil.; Naphthol AS, dark crimson plates with brown reflex (toluene), M. P. 270°, blue solution in H_2SO_4, bluish red precipitate on dil.

2-Naphthylamine



$C_{10}H_9N$; Mol. Wt. 143.13; (C, 83.9%; H, 6.3%; N, 9.8%)

Odourless, pearly white plates or leaflets, M. P. 111–2°, B. P. 294°(306° cor.). Moderately volatile with steam. Soluble in hot H_2O, sparingly soluble in cold. The solutions have a blue fluorescence. The sulphate is much less soluble than the hydrochloride.

Monoacetyl deriv., M. P. 132.5°; diacetyl deriv., colourless plates, M. P. 66.5°, readily soluble in org. solv.

Salts: Sym. trinitrobenzoate, (yellow), M. P. 156° (decomp.); 2, 4, 6-tribrom-3-aminobenzoate, colourless needles, M. P. 142–3°; *m*-nitrobenzoate, long, pale yellow needles (C_6H_6), M. P. 119°; benzene mono-sulphonate, M. P. 248°; 1-naphthalene sulphonate, M. P. 200–1°; 2-naphthalene sulphonate, M. P. 275–6°; 2, 6-naphthalene disulphonate, M. P. >360°; 2, 7-naphthalene-disulphonate, M. P. 295°. (For data on the solubilities and optical properties of these and other, salts see *J. Chem. Soc.*, **75**, 580; *J. Soc. Chem. Ind.*, **43**, 165, 299; *Ind. Eng. Chem.*, **12**, 1081, 1085, 1194; **14**, 317.)

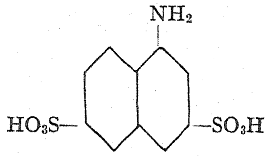
Additive comp. with: *m*-dinitrobenzene, red needles, M. P. 57°; sym. trinitrobenzene, brick-red needles, M. P. 160° (its acetyl deriv. yellow needles M. P. 142°); trinitrotoluene, red needles (its acetyl deriv. yellow needles, M. P. 106°); ethyl trinitrobenzoate, prune needles, M. P. 127°; picramide, purple-black needles, M. P. 161.5°; 4, 6-dichlor-1, 3-dinitrobenzene, brown-red needles, M. P. 67–8°; 2, 4-dichlor-1, 3, 5-trinitrobenzene, blue-black cryst., M. P. 72°, sym. trinitroethylbenzene, purple-red needles, M. P. 61–3°; tetryl, black prisms, M. P. 90°; *β*-naphthol, M. P. 125–6°; 1, 3, 5-trinitronaphthalene, purple-red needles, M. P. 138°; 1, 3, 8-trinitronaphthalene,

red prisms, M. P. 132–3°; 1, 3, 5, 7-tetranitronaphthalene, black needles, M. P. 220–1°; 1, 3, 5, 8-tetranitronaphthalene, bronze-green needles, M. P. 163–4°; 1, 3, 6, 8-tetranitronaphthalene, brown plates, M. P. 211–2°.

Condensation prod. with: *p*-brombenzene sulphonyl chloride, M. P. 129°; *m*-nitrobenzene sulphonyl chloride, M. P. 165.5°; 1-halogen-2-naphthol, M. P. 166–7°; 2, 3, 4-trinitrotoluene (red), M. P. 166°; 3, 4, 6-trinitrotoluene (orange), M. P. 211°; 2, 4, 6-trinitrobenzaldehyde (yellow), M. P. 192°; tetranitraniline (red), M. P. 212°; picrylaniline, small brick-red cryst., M. P. 231.5°; 4, 6-dichlor-1,3-dinitrobenzene, orange-red turning yellow at 180° and melting at 183°.

Diazotised and coupled with : 1-naphthol, dark red cryst. pdr. (AcHO), M. P. 174°, wine-red sol. in H_2SO_4, red ppt. on dil.; Naphthol AS, red cryst. pdr. (AcHO), M. P. 211°, blue sol. in H_2SO_4, red ppt. on dil.

1-Naphthylamine-3, 6-disulphonic Acid



$C_{10}H_9NO_6S_2$; Mol. Wt. 303.25; (C, 39.6%; H, 3.0%; N, 4.6%; O, 31.7%; S, 21.1%).

Small needles, readily soluble in H_2O. The salts with alkalies and alkaline earths are also readily soluble.

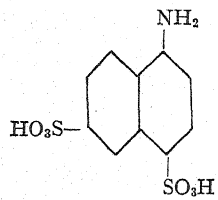
By treatment with sod. amalgam 1-naphthylamine is obtained.

By heating with three pts. of water at 180° it gives 1-naphthol-3, 6-disulphonic acid.

It may be converted into 1-chlornaphthalene-3, 6-disulphonyl chloride, M. P. 114° (or 127°), and into 1, 3, 6-trichlornaphthalene, M. P. 80.5°.

It is converted into the sparingly sol. 1, 3-diaminonaphthalene-6-sulphonic acid by NH_3 at 180°, and into the 1, 3-diphenylamino deriv. by aniline at 15–60°.

1-Naphthylamine-4, 6-disulphonic Acid



$C_{10}H_9NO_6S_2$; Mol. Wt. 303.25; (C, 39.6%; H, 3.0%; N, 4.6%; O, 31.7%; S, 21.1%).

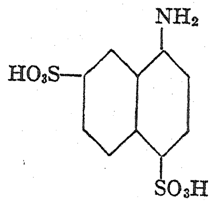
Needles, readily soluble in hot H_2O, less soluble in cold. The neutral Na salt is readily soluble, and the acid Na salt (needles) dissolves in 6 parts H_2O at 20°. The Ca salt (needles) is soluble in H_2O and in 85% alcohol, but is insoluble in 96% alcohol.

Alkaline fusion at 180–200° yields 5-amino-2-naphthol-8-sulphonic acid, and at 200–220° 1, 6-dihydroxynaphthalene-4-sulphonic acid.

It may be converted into 1-chlornaphthalene-4, 6-disulphonyl chloride, M. P. 126–7°, and into 1, 4, 6-trichlornaphthalene, M. P. 66° (and 56°).

With aniline at 180° it yields phenyl-1-naphthylamine-6-sulphonic acid.

1-Naphthyiamine-4, 7-disulphonic Acid



$C_{10}H_9NO_6S_2$; Mol. Wt. 303.25; (C, 39.6%; H, 3.0 %; N, 4.6% O, 31.7%; S, 21.2%).

Small needles. Sols. of the acid and its salts fluoresce blue.

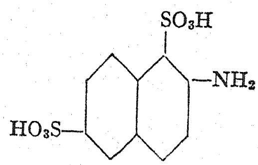
The normal sodium salt crystallises with $3H_2O$ and is readily soluble. The acid sodium salt is soluble in 140 parts H_2O at 20° or 20 parts at the B. P. The calcium salt is sparingly soluble in H_2O. The latter two salts are nearly insoluble in 85% alcohol.

On diazotisation and boiling with dil. HNO_3 it yields Naphthol Yellow S.

It may be converted into 1-chlornaphthalene-4,7-disulphonyl chloride, M. P. 107° and into 1, 4, 7-trichlornaphthalene.

Heated with aniline it yields phenyl-1-naphthylamine-7-sulphonic acid.

2-Naphthylamine-1, 6-disulphonic Acid



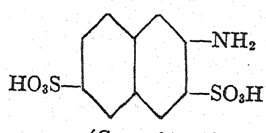
$C_{10}H_9NO_6S_2$; Mol. Wt. 303.25; (C, 39.6%; H, 3.0%; N, 4.6%; O, 31.7%; S, 21.1%)

Small needles, readily soluble in H_2O, difficultly sol. in alcohol.

The neutral alkali salts are very soluble, but the acid alkali salts are only sparingly so. Dilute sols. of the acid and acid salts fluoresce blue (weakly).

It may be converted into 2-chlornaphthalene-1,6-disulphonyl chloride, M. P. 124.5°, and into 1, 2, 6-trichlornaphthalene, M. P. 92.5°.

2-Naphthylamine-3, 6-disulphonic Acid



$C_{10}H_9NO_6S_2$; Mol. Wt. 303.25; (C, 39.6%; H, 3.0%; N, 4.6%; O, 31.7%; S, 21.1%)

It gives an orange colour with chlorinated pyridine.

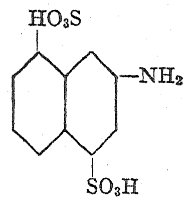
It may be converted into 2-chlornaphthalene-3,6-disulphonyl chloride, M. P. 165°, and into 2, 3, 6-trichlornaphthalene, M. P. 91°.

On alkaline fusion at 230–50° it yields 3-amino-2-naphthol-7-sulphonic acid.

Its diazo comp. forms sparingly sol. small yellow needles.

It gives a hydrazine comp. which yields naphthalene-2, 7-disulphonic acid on heating with copper sulphate.

2-Naphthylamine-4, 8-disulphonic Acid



$C_{10}H_9NO_6S_2$; Mol. Wt. 303.25; (C, 39.6%; H, 3.0%; N, 4.6%; O, 31.7%; S, 21.1%)

Concentric grouped prisms. Sparingly soluble in moderately conc. H_2SO_4. Alk. sols. fluoresces deep blue. It gives an in tensered colour and ppt. with chlorinated pyridine.

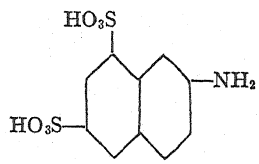
The acid Ba salt (needles) is sp. sol. in H_2O, the acid Na salt (needles) sp. sol. in alcohol.

The acid does not couple with diazotised bases.

It yields 2-naphthol-4-sulphonic acid with 10% H_2SO_4 at 170–185° and 2-amino-4-naphthol-8-sulphonic acid with potassium hydroxide at 215°.

Heated with aniline and aniline hydrochloride at 150–170° it yields 1, 3-diphenylamino naphthalene-5-sulphonic acid.

2-Naphthylamine-6, 8-disulphonic Acid



$C_{10}H_9NO_6S_2$; Mol. Wt. 303.25; (C, 39.6%; H, 3.0%; N, 4.6%; O, 31.7%; S, 21.1%)

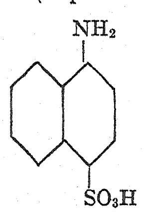
Small fine monoclinic needles (+4HO). Sol. in 9.82 pts. H_2O at 20°. The salts are readily soluble (see *Helv. Chim. Acta*, 1923, **6**, 1146). The acid fluoresces blue. It gives a yellow-red colour with chlorinated pyridine.

With R-salt it gives a very sp. sol. red azo dye which is pptd. at once even at great dilutions. With an acetic acid sol. of diazotised nitraniline it gives a diazoamino comp.

It may be converted into 2-chlornaphthalene-6, 8-disulphonyl chloride, M. P. 170°, and into 1, 3, 7-trichlornaphthalene, M. P. 113°.

It gives 2-amino-8-naphthol-6-sulphonic acid on alk. fusion (200–230°).

1-Naphthylamine-4-sulphonic Acid (Naphthionic Acid)



$C_{10}H_9NO_3S$; Mol. Wt. 223.19; (C, 53.3%; H, 4.1%; N, 6.3%; O, 21.9%; S, 14.4%)

Small, glittering, colourless needles. Very sparingly soluble in H_2O (1 part in about 4,000 at 15°), nearly insoluble in alcohol. Aqueous solutions of the acid and its salts fluoresce blue. The latter give loam coloured ppts. with $FeCl_3$, sol. on heating, with dark colour.

Na salt ($+4H_2O$) large monoclinic prisms, readily soluble in H_2O but insoluble in alcohol.

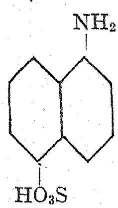
Amide, brown-yellow needles (alc.), M. P. 206°; gives an acetyl deriv., small needles (alc.), M. P. 241°.

Acet-naphthionic acid-ethyl ester, while needles, M. P. 148°; acet-naphthionic acid-dianilide, leaflets (alc.), M. P. 231°. Heated with sod. bisulphite and with NaOH naphthionic acid yields 1-naphthol-4-sulphonic acid. Heated with conc. HNO_3 and poured into water it yields 2.4-dinitro-1-naphthol, M. P. 138°. With steam at 180° in 65% H_2SO_4 the sulphonic group is split off at once. It does not form naphthoquinone on oxidation. It forms an azoxy dye on oxidation with warm alkaline $K_3Fe(CN)_6$, which dissolves in hot water with a red-brown colour and dye wool yellow.

It may be converted into 1-chlornaphthalene-4-sulphonyl chloride, M. P. 95°, and into 1, 4-dichlornaphthalene, M. P. 67–8°.

(For absorption data on the dye obtained by diazotizing and coupling with 1-naphthol-2-sulfonic acid, see *J. Assoc. Off. Agr. Chem.*, 1922, **6**, 16.)

1-Naphthylamine-5-sulphonic Acid (Laurent's Acid)



$C_{10}H_9NO_3S$; Mol. Wt. 223.19; (C, 53.3%; H, 4.1%; N, 6.3%; O, 21.9%; S, 14.4%)

Microscopic needles. Sol. in 950 pts. H_2O at 15°; rather easily sol. in hot H_2O. Sols. of the acid and its salts fluoresce green.

Na salt ($+1H_2O$), leaflets, sol. in alcohol and in H_2O.

Zn salt ($+9H_2$), flat needles, rather difficultly sol. in H_2O.

Amide, glittering plates (alc.), M. P. 259–60°; gives an acetyl deriv., M. P. 231–2° and a diacetyl deriv., M. P. 200°.

Its diazo deriv. is yellow.

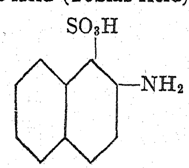
With bromine water it gives an intense violet colour, quickly turning cherry-red and fading.

On acetylation and sulphonation it gives 1-naphthylamine-5, 7-disulphonic acid.

It may be converted into 1-chlornaphthalene-5-sulphonyl chloride, M. P. 95°, and into 1, 5-dichlornaphthalene, M. P. 107°.

On boiling with nitric acid it yields 2, 4-dinitro-1-naphthol, M. P. 138°.

2-Naphthylamine-1-sulphonic Acid (Tobias Acid)



$C_{10}H_9NO_3S$; Mol. Wt. 223.19; (C, 53.3%; H, 4.1%; N, 6.3%; O, 21.9%; S, 14.4%).

Sparingly sol. in H_2O, crystallising in anhydrous leaflets from hot H_2O and in efflorescent hydrated needles from cold H_2O. The pure ammonium salt does not fluoresce (in sols.).

Na salt ($+1H_2O$), leaflets, readily soluble in H_2O.

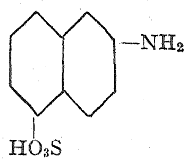
The diazo comp. is nearly insoluble in H_2O and separates in sulphur-yellow cryst.

The amino group of the acid may be replaced by chlorine by the Sandmeyer method. The resulting 2-chlornaphthalene-1-sulphonic acid gives a chloride, plates, M. P. 76°, and an amide, M. P. 153°.

By distillation with P_2Cl_5 1, 2-dichlornaphthalene, M. P. 35°, is obtained.

The sodium salt is converted into sodium-2-naphthylsulphamate by heating to 230°.

2-Naphthylamine-5-sulphonic Acid



$C_{10}H_9NO_3S$; Mol. Wt. 223.19; (C, 53.3%; H, 4.1%; N, 6.3%; O, 21.9%; S, 14.4%)

Long, fine white needles. Sol. in 1,300 parts cold H_2O and in 260 parts of boiling H_2O.

Na salt ($+5H_2O$), colourless transparent plates which effloresce in air, turning yellowish. Sol. in 10 parts hot 95% alcohol.

Sols. of the salts fluoresce red-blue.

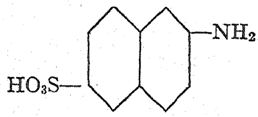
The diazo comp. is a microcryst. green-yellow pdr. Coupled with 1-naphthol it gives a red dye, turned blue-violet by HCl; coupled with 2-naphthol it gives a red-orange dye, fast to acids.

It may be converted into 2-chlornaphthalene-5-sulphonyl chloride, M. P. 76°, and into 1, 6-dichlornaphthalene, M. P. 48°.

On fusion with KOH at 260–70° it gives 2-amino-5-naphthol.

With ethylnitrite it gives 1-naphthalene sulphonic acid.

2-Naphthylamine-6-sulphonic Acid (Brönner's Acid)



$C_{10}H_9NO_3S$; Mol. Wt. 223.19; (C, 53.3%; H, 4.1%; N, 6.3%; O, 21.9%; S, 14.4%)

Prismatic needles or silky plates. Soluble in 630 pts. boiling H_2O

Aqueous solutions of the acid and its salts fluoresce blue.

Na salt ($+2H_2O$), silky needles, sol. in 40 pts. cold H_2O.

Ba salt ($+6H_2O$), long, silky needles, soluble in 450 pts. cold H_2O.

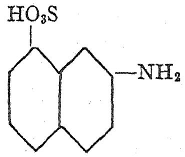
On strong heating the salts give 2-naphthylamine.

With sod. hypochlorite the sod. salt yields 1, 2-naphthazine-6, 6′-disulphonate, fine green-yellow powder sol. in H_2O, with a yellow colour and in conc. H_2SO_4, with a violet colour.

It may be converted into 2-chlornaphthalene-6-sulphonyl chloride, M. P. 109°, and into 2, 6-dichlornaphthalene, M. P. 135°, B. P. 285°.

The diazo comp. is yellow and moderately sol.

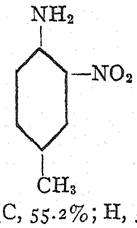
2-Naphthylamine-8-sulphonic Acid (Badische Acid)



$C_{10}H_9NO_3S$; Mol. Wt. 223.19; (C, 53.3%; H, 4.1%; N, 6.3%; O, 21.9%; S, 14.4%)

Small needles, soluble in 1,700 pts. of cold H_2O.
Na salt, large prisms, difficultly sol. in 95% alcohol.
(The colour of the acid is reported as grey-violet, and that of its salts as rose-red by one investigator.)
Solutions of the acid and its salts fluoresce blue.
It gives a sparingly sol. green-yellow diazo comp.
It gives 2-naphthol-8-sulphonic acid on boiling with an excess of sodium bisulphite and acidifying.
It gives 2-amino-8-naphthol on fusion with KOH at 260–70°.
It may be converted into 2-chlornaphthalene-8-sulphonyl chloride, M. P. 129°, and into 1, 7-dichlornaphthalene, M. P. 62.5°.

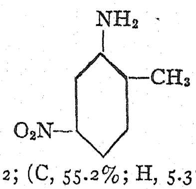
3-Nitro-4-toluidine



$C_7H_8N_2O_2$; Mol. Wt. 152.12; (C, 55.2%; H, 5.3%; N, 18.4%; O, 21.0%).

Small red prisms (alc.). M. P. given variously, 114–118°. Very difficultly soluble in hot H_2O, readily in alcohol. Volatile with steam.
Acetyl deriv., yellow needles, M. P. 94–6°, very slightly soluble in H_2O, mod. sol. in alcohol. Diacetyl deriv., massive citron-yellow prisms, M. P. 78°.
Diazotised and coupled with: β-naphthol, long red needles (AcHO), M. P. 278°, violet sol. in H_2SO_4, red ppt. on dil.; Naphthol AS, red-brown needles (Ac HO), M. P. 284°, wine-red sol. in H_2SO_4, red ppt. on dil.
With iodine monochloride (AcHO) it gives 3-nitro-5-iodo-4-toluidine golden brown needles (alc.), M. P. 98°. The acetyl deriv. forms colourless needles (alc.) melts at 202–3°.

4-Nitro-2-toluidine



$C_7H_8N_2O_2$; Mol. Wt. 152.12; (C, 55.2%; H, 5.3%; N, 18.4%; O, 21.0%).

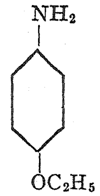
Orange prisms with intensely sweet taste. M. P. 107°, about 311°. Dissolves in 100 parts boiling H_2O and is sl. volatile with steam.
Acetyl deriv., yellowish needles, M. P. 150–1°.

Salts with: Benzenemonosulphonic acid, M. P. 222°, 100 grm. aqueous solution cont. 1.84 grm. salt at 15°; 1-naphthalene sulphonic acid, M. P. 244°, 100 grm. aqueous solution cont. 0.11 grm. salt at 15°; β-naphthalene sulphonic acid, M. P. 229–30°, 100 grm. aqueous solution cont. 0.12 grm. at 15°; 1, 8-di-aminonaphthalene-3, 6-disulphonic acid, M. P. 270° (decomp.),. 186 pt. salt sol. in 100 H_2O at room temp.; H-acid, gray prisms, M. P. 260° (decomp.), 0.106 pt. salt sol. in 100 H_2O at room temp.

Diazotised and coupled with: β-naphthol, long red brown needles (AcOH), M. P. 206°, magenta-red sol. in H_2SO_4, orange-red ppt. on dil.; Naphthol AS, red needles with green reflex (AcOH), M. P. 304°, red sol. in H_2SO_4, yellow-red ppt. on dil.

With iodine monochloride (AcHO) it gives 4-nitro-5-iodo-*o*-toluidine, yellow prisms (alcohol), M. P. 109°.

4-Phenetidine



$C_8H_{11}NO$; Mol. Wt. 137.14; (C, 70.0%; H, 8.1%; N, 10.2%; O, 11.7%).

Liquid. M. P. 2.4° (cor.), B. P. 254.2–7° (cor.). D = 1.0613 at 15°.

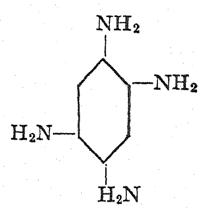
Hydrochloride, glittering, iridescent, rhombic plates, M. P. 234° sublimes in long spears, readily soluble in H_2O, sols. coloured red by $FeCl_3$ or bleaching pdr.; citrate, prisms, M. P. 186°; acid citrate, white cryst., M. P. 150°; benzenesulphonate, M. P. 171°, 21 grm. salt in 100 grm. aqueous solution at 17°; β-naphthalenesulphonate, M. P. 201–2°, 100 grm. aqueous solution contain .19 grm. salt at 15°; β-naphthalene-sulphonate, M. P. 207°, 100 grm. aqueous solution contain 0.20 grm. salt at 15°; 2, 6-naphthalenedisulphonate, M. P. >300° (decomp.), 100 grm. aqueous solution contain 0.13 grm. salt at 15°; 2, 7-naphthalenedisulphonate, M. P. 230°, readily soluble.

Formyl deriv.; leaflets, M. P. 69°, difficultly soluble in cold H_2O, readily in hot; acetyl deriv. (phenacetin); white leaflets, M. P. 134–5°, sol. in 70 pts. boiling H_2O; diacetyl deriv.; needles (ligroine) M. P. 53.5–54°, B. P. 182° at 12 mm., soluble in about 400 pts. H_2O at room temp.

Condens. prod. with: *p*-bromobenzenesulphonyl chloride, cryst., M. P. 143°; sym. trinitrobenzaldehyde, cryst. (alc.), M. P. 177°.

Diazotised and coupled with: β-naphthol, red-needles (toluene), M. P. 140°, red sol. in H_2SO_4, orange-red ppt. on dil.; Naphthol AS, dark-red plates (toluene), M. P. 218°, blue sol. in H_2SO_4, light-red ppt. on dil.

1, 2, 4, 5-Tetraminobenzene



$C_6H_{10}N_4$; Mol. Wt. 138.14; (C, 52.1%; H, 7.3%; N, 40 6%).

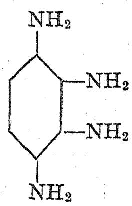
The free base is quickly oxidised by air (giving tetraminodiphenazine), Aqueous sols. of salts turn brown in air in presence of acids and blue-violet (imide deriv.) in their absence.

Acetyl deriv., long needles (AcHO), M. P. 285° (probably a triacetylethenyl deriv.), difficultly soluble in alcohol.

Hydrochloride: ($C_{10}H_{10}N_4.4HCl$), small prisms, very soluble in H_2O; difficultly soluble in HCl. Sulphates: tetrabasic salt with large excess H_2SO_4 tribasic salt, leaflets, mod. sol.; dibasic salt, needles, soluble with difficulty.

With phenanthrenequinone; orange-yellow needles, nearly insoluble in glac. AcHO, dissolves in H_2SO_4 with green-blue colour, on dilution giving a violet then red colour and finally a ppt. of the orange-yellow base.

1, 2, 3, 4-Tetraminobenzene



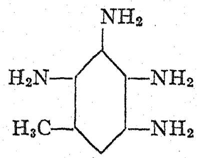
$C_6H_{10}N_4$; Mol. Wt. 138.14; (C, 52.1%; H, 7.3%; N, 40.6%).

The free base is rapidly oxidised by air. Solutions of salts turned brown by oxidising agents without formation of characteristic imide deriv. (distinction from sym. tetraminobenzene). Also distinguished from sym. isomer by its slighter basicity, giving only dibasic salt with H_2SO_4.

Acetyl deriv., long silky glittering needles, M. P. 260° (probably a triacetylethenyl deriv.).

Picrate, yellow leaflets, unstable. Sulphate ($C_6H_{10}N_4.H_2SO_4$), nearly colourless leaflets, scarcely soluble in cold H_2O, but readily soluble in HCl. Gives fine golden-yellow needles (alc.), M. P. 218°, with excess diacetyl (heat).

2, 3, 4, 5-Tetraminotoluene

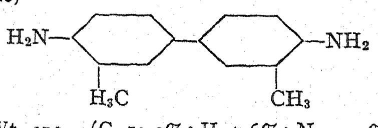


$C_7H_{12}N_4$; Mol. Wt. 152.16; (C, 55.2%; H, 7.9%; N, 36.8%).

The free base is very unstable. Forms two series of salts ($C_7H_{12}N_4.2H_2SO_4$, leaflets; $C_7H_{12}N_4.H_2SO_4$, small leaflets, insol. in alcohol).

By heating the sulphate with acetic anhydride and sodium acetate triacetylethenyltetraminotoluene (+H_2O), needles, M. P. 305° is obtained. On treatment with HCl this yields diacetylethenyltetraminotoluene, leaflets, M. P. 282°.

***o*-Tolidine (Tolidine)**



$C_{14}H_{16}N_2$; Mol. Wt. 212. (C, 79.2%; H, 7.6%; N, 13.2%)

Glistening pearly leaflets. M. P. 127–9°. Sol. in about 7,000 parts cold H_2O and 300 pts. hot H_2O. Readily soluble in alcohol and ether.

Hydrochloride, M. P. over 340° (decomp.), soluble in 17.34 parts H_2O at 12°; acid hydrochloride, lustrous scales, decomp. above 300° without melting,

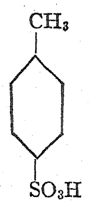
soluble in 112.4 pts. H_2O at 12°; sulphate, difficultly soluble in H_2O or alcohol; dipicrate, yellow cryst., decomp. at 215°; benzene monosulphonate, M. P. 310°, benzene-2, 6- and 2, 7-disulphonates, both melt above 360° and are very sparingly soluble; 1-naphthalenesulphonate, M. P. 294°, soluble in about 400 pts. H_2O at 15°; 2-naphthalenesulphonate, M. P. over 330°, very sparingly soluble. The salt with H-acid (+$3H_2O$) melts at 260² (decomp.) and is soluble in about 1,000 parts H_2O at room temp. (gray-violet prisms).

Additive comp. with sym. trinitrobenzene black cryst., M. P. 178° with sym. trinitroethylbenzene, violet-black prisms, M. P. 85°. With 2, 4-dinitrobenzaldehyde it gives an additive comp. in alc. (purple) M. P. 232° and a condens. prod. in AcHO (yellow-red), M. P. 282° (decomp.).

Diformyl deriv., microscopic needles, M. P. 254°; monoacetyl deriv. white plates (+$1H_2O$), M. P. 103°; nitroso acetyl deriv., brown cryst., M. P. 154–5°; diacetyl deriv., glittering needles, M. P. 306° (also given as 314°); tetraacetyl deriv., glittering needles (alc.), M. P. 211°; benzoyl deriv., M. P. 198–200°; dibensoyl deriv., needles, M. P. 265°.

Diazotised and coupled with: β-naphthol, dark needles with green reflex (toluene), M. P. 297°, soluble in H_2SO_4, with a blue colour, blue-violet ppt. on dil.; Naphthol AS, dark violet minute cryst., M. P. over 320°, sol. in H_2SO_4, with a blue colour, blue-violet ppt. on dil.

4-Toluenesulphonic Acid

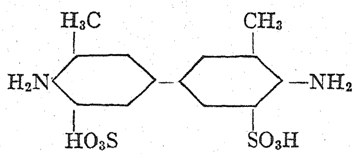


$C_7H_8O_3S$; Mol. Wt. 172; (C, 48.8%; H, 4.6%; O, 27.3%; S, 19.3%)

$C_7H_8O_3S + 4H_2O$. Leaves or prisms. M. P. 92°. By fusing with an excess of potassium hydroxide *p*-cresol and *p*-hydroxybenzoic acid are obtained.

Dimethylamine addition compound M. P. 78°. Sol. in 1 pt. of water at 23° and in 2 pts. of alc.

***o*-Tolidine Disulphonic Acid**

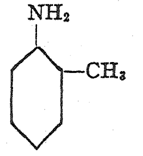


$C_{14}H_{16}N_2O_6S_2$; Mol. Wt. 372.33; (C, 45.1%; H, 4.3%; N, 7.5%; O, 25.8%; S, 17.2%)

Small white needles (H_2O), readily sol. in hot H_2O. The tetrazo deriv. is insol. in H_2O.

The salts are readily soluble in H_2O and are easily crystallised. Na salt (+$4H_2O$), cubes; Ca salt (+$5H_2O$), silvery glittering leaflets resembling mica; Ba salt (+$3H_2O$), needles.

o-Toluidine



C_7H_9N; Mol. Wt. 107.12; (C, 78.5%; H, 8.4%; N, 13.1%).

Colourless oily fluid. Dimorphous, M. P.; alpha, −21°; beta −15.5°. Boils at 197–200°. D. 1.003 at 15°. Volatile with steam (34 grm. passing over with 1 liter).

Acetyl deriv., orthorh. cryst., M. P. 109–10°. 0.86 pt. sol. in 100 H_2O at 19°, 8.08 parts in alcohol. B. P. 296° (172° at 11 m.m. 227° at 100 m.m.). (Cl derivs.—see *J. Am. Chem. Soc.*, **47**, 1095.)

Diacetyl deriv., pyramids, M. P. 18°.

Salts.—Hydrochloride, M. P. 215°; hexabromplatinate, shining yellow-red, silky needles, M. P. 225–6° (decomp.); benzene sulphonate, M. P. 176°, soluble in 5 parts H_2O at 19°; α-naphthalene sulphonate, M. P. 237°, .99 grm. salt in 100 grm. aqueous solution at 15°; β-naphthalene sulphonate, M. P. 213°; 0.47 grm. salt in 100 grm. aqueous solution at 15°; 2, 7-naphthalene disulphonate, M. P. 238°, 6.1 grm. salt in 100 grm. aqueous solution at 15°; 2, 6-naphthalene disulphonate, M. P. 338° (decomp.), 0.78 grm. salt in 100 grm. aqueous solution at 15°.

Additive comp.:—With $SbCl_3$, long colourless needles (alc.), M. P. 148°; with 2, 4, 6-trinitrobenzaldehyde, M. P. 106°; with 2, 4, 6-trinitrostilbene, red glittering leaflets, M. P. about 120°; with tetryl, brick-red cryst. (C_6H_6), M. P. 63°; with sym. trinitroethylbenzene, blood-red prisms (alc.), M. P. 35°.

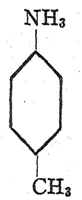
Condensation products; with 2, 4, 6-trinitrobenzaldehyde, 2, 4, 6-trinitrobenzal-o-toluidine, yellow, M. P. 177°; with tetranitraniline, 2, 4, 6-trinitro-3-aminophenyl-o-toluidine, dark-red, M. P. 200°; with 1-halogen-2-naphthols, 1-o-tolylamino-2-hydroxynaphthalene, M. P. 114–5°; with 1-chlor-2, 4-dinitrobenzene 2, 4-dinitrophenyl-o-toluidine, citron, yellow cryst. (alc.), M. P. 120°; with 3, 4, 6-trinitrotoluene, 4, 6-dinitro-3-6′-dimethyldiphenylamine, brown-red, M. P. 99°, with 2, 3, 5-t.n.t. the 2, 2′-isomer of the preceding, tangerine-red, M. P. 109°. With *p*-brombenzenesulphonyl chloride the product obtained melts at 116°;—with 1-dinitrochlorbenzene the product melts at 101–2°.

Diazotised and coupled with;—1-naphthol, red needles (AcHO), M. P. 128°, wine-red sol. in H_2SO_4, yellow-red ppt. on dil.;—Naphthol AS, glistening bronze leaflets (AcHO), M. P. 220°, wine-red sol. in H_2SO_4 light red ppt. on dil.;—1-naphthol-2-sulphonic acid (see *J. Assoc. Off. Agr. Chem.*, **6**, 16, for absorption data.)

Shaken with CS_2 and H_2O_2 it gives sym-di-o-tolyl-sulphurea, M. P. 165°.

Filter paper impregnated with o-toluidine gives an orange-brown colour if dipped in dil. H_2SO_4 containing a few drops of HNO_3 and then in conc. H_2SO_4.

p-Toluidine



C_7H_9N; Mol. Wt. 107.12; (C, 78.5%; H, 8.4%; N, 13.1%).

Colourless plates or leaflets. M. P. 45°, B. P. 200–1° (86–7° at 10 m.m.), D, 1.046. Volatile with steam (33 grm. passing over with 1 litre). Dissolves in 285 parts H_2O at 11.5°, in 135 parts at 21°.

Acetyl deriv., monocl. rhomb., M. P. 153°, B. P. 307°, 0.0886 part sol. in 100 cc. H_2O at 22°, 8.416 pts. in alc. Aceto acetyl deriv., prisms (ethyl acetate), M. P. 94–5° (Ewins and King); white flat plates (H_2O), M. P. 89° (Dains and Harger). Diacetyl deriv. colourless cryst., M. P. 48°.

Salts; Picrate, long, light-yellow prisms, M. P. 169° (decomp.) 100 pts. H_2O at 18.5° dissolve 0.54 pts. salt. 100 pts. 95% alc. at 18° 23.33 grm. salt; hexabromplatinate, glistening yellow-red spears and plates, M. P. 268–9°; benzene sulphonate, M. P. 205°, 7.4 grm. salt in 100 grm. aqueous solution at 16°; 1-naphthalene sulphonate, M. P. 181°, 1.38 gm. salt in 100 grm. aqueous solution at 15°; 2-naphthalene sulphonate, M. P. 221°, 0.47 grm. salt in 100 grm. aqueous solution at 16°; 2, 7-naphthalene disulphonate, M. P. 299°, 1.07 grm. salt in 100 grm. aqueous solution at 15°; 2, 6-naphthalene disulphonate, M. P. >360°, 0.02 grm. salt in 100 grm. aqueous solution at 15°; anthraquinone-2-sulphonate, needles, M. P. 308°, sol. in 2,500 prts. H_2O.

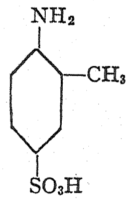
Additive comp.;—With $SbCl_3$, colourless cryst., decomp. above 120°; —with tetryl, deep red needles, M. P. 54°;—with sym. trinitrotoluene, long red needles (C_6H_6), M. P. 68–70°:—with sym. trinitroethylbenzene, blood-red needles, M. P. 25°; with bromonitro-styrene, gold-yellow plates (alc.) M. P. 107–8°.

Condensation prod.;—With tetryl, 2, 4, 6-trinitrophenyl-*p*-tolyamine, orange-red needles or blood-red prisms, M. P. 163–5°; with 1-halogen-2-naphthol, 1-*p*-tolylamino-2-hydroxynaphthalene, M. P. 138–9° (Methyl ether, M. P. 94°); with tetranitraniline, 2, 4, 6-trinitro-3-aminophenyl-*p*-tolylamine, orange M. P. 220°; with 2, 4, 6-trinitrobenzaldehyde, 2, 4, 6-trinitrobenzal-*p*-toluidine, M. P. 179.5°; with 1-chlor-2, 4-dinitrobenzene, 2, 4-dinitrophenyl-*p*-toluidine, red needles (alc.) M. P. 131°, with 1-brom.-3, 4, 6-trinitrobenzene, 5-brom.-2, 4-dinitro-4′-methyldiphenylamine bright yellow prisms, M. P. 164–5°. With *p*-brom-benzensulphonyl chloride the product obtained melts at 98°.

Diazotised and coupled with:—*β*-naphthol, orange-red needles (AcHO), M. P. 130°, wine-red sol. in H_2SO_4, orange-red pptte. on dil.;—Naphthol AS, red needles with green reflex (AcHO), M. P. 225°, wine-red sol. in H_2SO_4, light red pptte. on dil.:—with 1-naphthol-2-sulphonic acid (see *J. Assoc. Off. Agr. Chem.*, **6**, 16, for absorption data).

Filter paper impregnated with *p*-toluidine gives a rose-red colour when dipped in dil. H_2SO_4 containing a few drops of HNO_3 and then in conc. H_2SO_4.

2-Toluidine-5-sulphonic Acid (*m*-sulpho-*o*-toluidine)



$C_7H_9NO_3S$; Mol. Wt. 187.18; (C, 44.9%; H, 4.9%; N, 7.5%; O, 25.6%; S, 17.1%).

Cryst. in rhombic prisms with $1H_2O$, which it loses over H_2SO_4. 100 pts. aqueous solution contain 2.69 pts. anhyd. acid at 11°, 100 pts. 70% alcohol, 2.105 pts. at 17.5°. Readily sol. in hot H_2O.

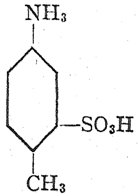
Ba salt (+3(?)H_2O); large rhombic leaflets. Anhyd. salt sol. in 7.9 pts. H_2O.

Sulphamide; large four-sided prisms, M. P. 175°. Its hydrochloride; long, fine, silky needles, M. P. 240°.

The acid does not reduce ammon. Ag. sols. and gives no ppt. with bromine water. Cold aqueous solutions are coloured rose, then chrome-green by small amounts of PbO_2 (dark-violet with excess). With $FeCl_3$ it gives a green-yellow colour, then olive and finally dark violet.

Aqueous solutions heated to 180–200° give *o*-toluidine. With oxidising agents toluquinone is formed.

4-Toluidine-2-sulphonic Acid (*o*-sulpho-*p*-toluidine)



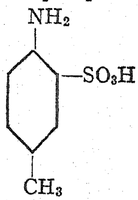
$C_7H_9NO_3S$; Mol. Wt. 187.18: (C 44.9%: H, 4.9%; N, 7.5%; O, 25.6%; S, 17.1%).

Monocl. cryst. with $1H_2O$ which is not lost over H_2SO_4 100 grm. aqueous solution contain 0.45 grm. hydrated acid at 20°. Insol. in alc.

The K salt is very soluble in cold KOH solution (in contradistinction from the K salt of *m*-sulpho-*p*-toluidine).

Sulphochloride, small colourless prisms, M. P. 124°. Its anilide cryst. in colourless rhomb. leaflets (alc.) M. P. 220–1°,

4-Toluidine-3-sulphonic Acid (*m*-sulpho-*p*-toluidine)

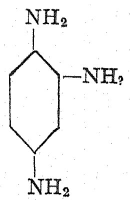


$C_7H_9NO_3S$; Mol. Wt. 187.18; (C, 44.9%; H, 4.9%; N, 7.5%; O, 25.6%; S, 17.1%).

Yellow needles ($+\frac{1}{2}H_2O$), soluble in 10 pts. cold H_2O. Unlike the *o*-sulpho isomer it is sol. in alc. Its Pb salt is much less soluble in H_2O than that of the *o*-sulpho isomer. Its K salt is insol. in cold KOH solution, whereas the K salt of the *o*-sulpho isomer is soluble.

Cold aqueous solutions are coloured wine-red by a little PbO_2 and wine-yellow by $FeCl_3$, turning redder on warming. It reduces ammon. Ag. solutions. Aqueous solutions heated to 180° yield *p*-toluidine. On fusion with alkalies it yields *p*-oxybenzoic acid.

1, 2, 4-Triaminobenzene



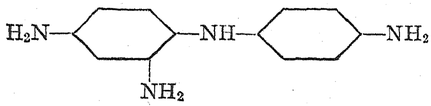
$C_6H_9N_3$; Mol. Wt. 123.13; (C, 58.5%; H, 7.4%; N, 34.1%).

Leaflets ($CHCl_3$). M. P. below 100°, B. P. about 340°. Readily soluble in H_2O and alcohol, in $CHCl_3$ with some difficulty and in ether with considerable difficulty. Turns brown quickly in air. Aqueous solutions turned wine-red by $FeCl_3$, red brown by acid nitrite solution.

Hydrochloride; ($C_6H_9N_3.2HCl$), needles; easily soluble in H_2O, with difficulty in alcohol and in HCl. Sulphate: difficulty soluble in cold H_2O.

Triacetyl deriv., M. P. 235°, gives an anhydro-deriv. which melts at 248°.

2, 4, 4′-Triaminodiphenylamine

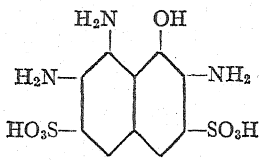


$C_{12}H_{14}N_4$; Mol. Wt. 214.20; (C, 67.3%; H, 6.6%; N, 26.2%).

By oxidation with dichromate in the presence of aniline it yields *p*-aminophenosafranine.

By treatment with benzaldehyde tribenzilidine-triaminodiphenylamine is obtained, yellow flocks, insoluble in H_2O but soluble in acids without decomp. and readily soluble in org. solvents. (The N content is 11.7%.) On warming with 15% HCl this yields a second base (losing benzaldehyde) which melts to a brown syrup at 122–4°.

1.2.7-Triamino-8-naphthol-3, 6-disulphonic Acid

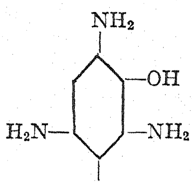


$C_{10}H_{11}N_3O_7S_2$; Mol. Wt. 349.28; (C, 34.4%; H, 3.2%; N, 12.0%; O, 32.1%; S, 18.4%).

A colourless cryst. powder which quickly turns blue on exposure to air. Aqueous solutions also rapidly turn bright blue. The ammon. solution on filter paper quickly turns deep blue-violet and finally gray-black, the violet colour giving a bright blue-green spot, and the gray colour a brilliant green with HCl. $FeCl_3$ (and HNO_2) give a thick blue ppt. which dissolves in dil. NaOH, giving a bright blue-red sol. (Green).

The colour reactions in Hesse's tests are: (1) violet, turning blue, (2) yellow or brown, (3) blue and (3a) red to violet.

1.3.5-Triamino-2-phenol.



$C_6H_9N_3O$; Mol. Wt. 139.13; (C, 51.8%; H, 6.5%; N, 30.2%; O, 11.5%).

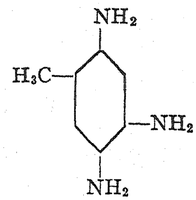
The free base is very unstable. Solutions of the salts oxidise very easily, reduce ammon. silver solutions, turn brown with alkalies and are coloured intense blue by $FeCl_3$ (formation of aminodiiminophenol).

Hydrochloride, pptd. from sol. by HCl, forms double salt ($C_6H_2(NH_2)_3$-$OH.3HCl.SnCl_2$) with $SnCl_2$, leaflets, cryst. from aqueous solution with 1½ H_2O. On long exposure over H_2SO_4 the latter loses 1 mol. HCl, turning orange-red.

Sulphite, slightly sol. leaflets, M. P. 120–1°; picrate, citron-yellow needles, M. P. 96–7°, dissolves in 500 pts. of H_2O at 15°.

Triacetyl deriv., micro. plates, M. P. 279°, slightly sol. in hot C_6H_6, $CHCl_3$ and ether; tetraacetyl deriv., micr. prisms (H_2O), M. P. 255° (decomp.), more soluble in H_2O and alcohol than the triacetyl deriv. and gives the latter deriv. with dilute alkalies; hexaacetyl deriv., prisms (alc.), M. P. 184°, readily sol. in H_2O and alc. (difficultly soluble in C_6H_6), gives the triacetyl deriv. with dilute alkalies.

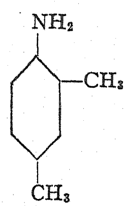
2, 4, 5-Triaminotoluene



$C_7H_{11}N_3$; Mol. Wt. 137.16; (C, 61.3%; H, 8.1%; N, 30.6%).

The free base is very unstable and is oxidised easily. Gives cryst. sulphate and hydrochloride ($C_7H_{11}N_3.3HCl$). Sols. of the salts reduce silver soluble in the cold. The salts in a moist condition soon turn red. On warming them with dil. H_2SO_4 an intense blue colour develops which disappears on the addition of alcohol. The hydrochloride gives a brown dye with potassium nitrite

***m*-Xylidine**



$C_8H_{11}N$; Mol. Wt. 121.14; (C, 79.3%; H, 9.2%; N, 11.5%).

Colourless oil, B. P. 212°. D = .9184 at 15°. Volatile with steam.

Acetyl deriv.; M. P. 129°, B. P. 170° at 10 m.m.; isonitroso-acetyl deriv., M. P. 161°.

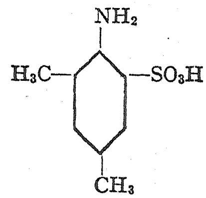
Hexabromoplatinate, yellow-red needles, M. P. 256°; benzenesulphonate, M. P. 233°, 100 grm. aqueous solution dissolve 1.46 grm. salt at 15°; 1-naphthalenesulphonate, M. P. 167°, 100 grm. aqueous solution contain 1.2 grm. salt at 15°; 2-naphthalenesulphonate, M. P. 211°, 100 grm. aqueous solution contain 0.27 grm. salt at 10°; 2, 7-naphthalene-disulphonate, M. P. 292–3°, soluble in 100 pts. H_2O at 15°; 2, 6-naphthalene-disulphonate, M. P. >360°; 100 grm. aqueous solution contain 0.35 grm. salt at 15°.

Additive comp. with: sym. trinitrobenzol, brownish-red cryst. M. P. 96–8°; sym. trinitrotoluol, red needles, M. P. 43–5°; sym. trinitroethylbenzol, glittering red prisms, (alc.), M. P. 52°.

Condens. prod. with: benzenesulphonylchloride, benzolsulpho-*m*-xylidine, cryst., M. P. 130–1°, soluble in alkalies (or the dibenzosulpho deriv., needles, M. P. 140°, insoluble in alkalies) bornylchloride, bornyl-*m*-xylidine, large needles (methyl alcohol), M P. 79°; tetryl, 2, 4, 6-trinitrophenyl-*m*-xylidine, orange-yellow needles, M. P. 157°; sym. trinitrobenzaldehyde, 2, 4, 6-trinitrobenzal-*m*-xylidine, M. P. 203°.

Diazotised and coupled with: β-naphthol, red needles (toluene), M. P. 166°, wine-red soluble in H_2SO_4, light-red ppt. on dil.; Naphthol AS, crimson feathery needles (toluene), M. P. 220°, deep-red sol. in H_2SO_4 red ppt. on dil.

***m*-4-Xylidine-5-sulphonic Acid**



$C_8H_{11}NO_3S$; Mol. Wt. 201.2; (C, 47.7%; H, 5.5%; N, 7.0%; O, 23.9%; S, 15.9%).

White, flat, quadratic rods or plates, insoluble in common org. solvents. One part sol. in 28.5 pts. H_2O at 100 and in 250 pts. H_2O at 0°. On strong heating it chars without melting.

Diazotised and coupled with: β-naphthol it gives golden-yellow microscopic leaflets which dye wool orange-yellow; resorcinol, red-brown leaflets which dye wool golden-yellow.

The Na salt cryst. in quadratic plates ($+2H_2O$).

THE ANALYSIS OF COLOURING MATTERS

BY H. E. FIERZ-DAVID AND V. E. YARSLEY, D.SC., M. SC., A. I. C.

The immense number of synthetic dyestuffs on the market, with their varied and often misleading commercial names, combined frequently with the extreme complexity of their structure, renders accurate analysis a matter of great difficulty and the determination of their constitution often an impossibility. Having regard, then, to the magnitude of the subject, the following outline must in no way be considered exhaustive or complete, but merely as an epitome of the methods available for the analytical investigation of colouring matters. In order to obtain accurate results the specific literature has to be consulted.

The standard work on this subject, to which reference is continually made, is "*The Analysis of Dyestuffs*" by Arthur G. Green. (Griffin, London, 1920.) Most of the other books dealing with the analysis of dyestuffs, both from the English and foreign press, are merely reproductions of this work, either with or without the consent of the author. Green devotes Chapters V, VI and VII (pp. 55–97) entirely to the treatment of dyestuffs on the fibre.

Other useful books of reference are J. Formánek and J. Knop, "*Untersuchung und Nachweis organischer Farbstoffe auf spectroskopischem Wege*" (Springer, Berlin, 1926) Part II; Schultz, "*Farbstoffe Tabellen;*" "*The Colour Index*" (Soc. Dyers and Colourists, 1924); Gnehm and Muralt, "*Taschenbuch für die Färberei*" (Sprigern, Berlin, 1924); and Fierz-David, (*Allen's Organic Analysis*, pp. 19 *et seq.*, this volume) which is based on Schultz and the Colour Index.

The subject is briefly treated by: Ristenpart "*Chemische Technologie der organischen Farbstoffe*" (Barth, Leipzig, 1925), pp. 263–280;

Ruggli, "*Praktikum der Färberei und Farbstoffanalyse*" (Bergmann, Munich, 1925), pp. 161–192; Cain and Thorpe, "*The Synthetic Dyestuffs*" (Griffin, London, 1920), pp. 385–394; Löwenthal, "*Handbuch der Färberei,*" (Berlin, 1923), pp. 1541; Lunge-Berl, "*Chemischtechnische Untersuchungsmethoden,*" (Springer, Berlin, 1924), Vol. IV, p. 922; Ullmann, "*Enzyklopädie*" Vol. V, p. 280; G. Schultz, "*Chemisch-technische Analyse,*" (third edition), Vol. III, p. 1087.

The specific literature dealing with the various branches of the subject is especially rich, and is briefly summarised under the respective subject headings as follows:

(a) **General.** C. Dreher, *Z. Farbenind.*, 1902, 415; E. T. Graves, *Prüfung der Teerfarbstoffe, Leipz. Färb. Ztg.*, 1904, 154; A. Peltzer, Ueber den Nachweis von Farbstoffen auf der Faser. *Färb. Ztg.*, 1907, 17; G. Nothnagel and R. Vive, *Zur Erkennung von Indanthren auf der Faser*, (*Veröff. des Militärsanitätswesens*, 1908, 20); G. Capron, *Quatitative Bestimmung der Farbstoffe auf gefärbter Baumwolle* (*Rev. g. des Mat. Col.*, 1908, 315); T. J. Efremenko, *Die Bestimmung der Farbstoffe auf Baumwollefaser* (*Z. angew. Chem.*, 1908, 1256); G. E. Holden, *The Consideration of new Vat dyes*, (*J. Soc. Dyers and Col.*, 1909, 47; *Z. angew. Chem.* 1909, 694); W. Bister, *Feststellung von Farbstoffen auf pflanzischer Faser* (*Z. für die ges. Textilind.*, 1915, 43), J. Herzfeld, *Technische Prüfung der Garne und Gewebe*, 1896 (Hartleben).

The tables of Green, which are similar to those of Weingärtner and Rota, are published in the *J. Soc. Dyers and Col.*, 1905, 226, (*Chem. Ztg.*, 1905, 363); 1907, 118 (*Chem. Ztg.*, 1907, Rep. 219); *M. Sc.* (4) 22, 23, (*Z. Farbenind.*, 1908, 73).

Vat dyes are treated by Green and Frank, "*The Reactions of Vat Dyes on Vegetable Fibres* (*J. Soc. Dyers and Col.*, 1910, 83, and Lunge-Berl, IV, 1021.) (Compare also Grandmougin, *Tabellarische Uebersicht der Küpenfarbstoffe.*

The literature dealing with the numerous black colouring matters is particularly rich, the more important contributions being: C. M. Whittaker, *Z. Farbenind.*, 1902, 397; A. Meienberg, *J. Soc. Dyers and Col.*, 1901, 61; *Leipz. Färb. Ztg.*, 1901, 240; F. Neurath *Z. Farbenind.*, 1902, 579; L. Matos, *Leipz. Färb. Ztg.*, 1909, 303; *Z. angew. Chem.*, 1909, 1777; E. Ristenpart, *Färb. Ztg.*, 1909, 45.

The literature on field grey dyestuffs includes E. Seel and A. Sanders, *Z. angew. Chem.*, 1915, 457, 1916, 92.

(b) **Colour Standards and Colour Comparison.**—The various methods of colour comparison, so important in relative qualitative investigations, have been exhaustively treated. Standard colour charts are: *Code de Couleurs* by Klincksieck and Valetta, Paris, 1908; P. Baumann's *Farbkarte*, Aue in Sa; P. Krais, *Verfahren und Systeme der Messung und Benennung der Farbtöne* (*Z. angew. Chem.*, 1914, **1**, 25; *Färb. Ztg.*, 1914, 133, and 1916, 163); H. Hillig, *Colour Names*, (*Färb. Ztg.*, 1916, 68).

The use of standard solutions of inorganic salts is recommended by Arny and Ring, *J. Franklin Inst.*, 1915, 199; *Z. angew. Chem.*, 1916, 11, 249.

Other useful works dealing with the subject are as follows: W. Ostwald, *Mathetische Farbenlehre*, (Leipzig, 1921); Farbenfibel, Zeitschrift " *Die Farbe*," in Verlag von Unesma, Leipzig; *Einführung in die Farbenlehre* (*Textilberichte*, 1920, 3, 256, 280; 1921, 105, 193; *Leipz. Monatsschr. f. Textilind.*, 1920, 109); P. Krais, *Z. angew. Chem.*, 1914, 25; 1921, 220; E. Ristenpart, *Färb. Ztg.*, 1920, 28; *Textilberichte*, 1920, 17; 1922, 92, 208, 297; *Leipz. Monatsschr. f. Textilind.*, 1922, 17, 78, 98, 157, 177; G. Gach, *Z. f. ges. Textil*, 1920, 296; 1921, 3, 138, 148, 422.: A. Weissbarth, *Konfektionär*, 1921, **2**, 1: R. Haller, *Textilberichte*, 1922, 433; A. v. Lagorio, *Z. angew. Chem.*, 1921, 585.

(c) **Aniline Lakes.**—A review of the coal-tar colouring matters generally used in the lake industry and their behaviour with different chemical reagents will be found in "*Tests for Coal-tar Colours in Aniline Lakes*," Zerr and Mayer, (Griffin, 1910).

(d) **Individual.**—*Nitro-derivatives.*—Knecht, *J. Soc. Dyers and Col.*, 1903, VI, 19.; the subject is also briefly treated in Knecht and Hibbert's "*New Reduction Methods in Volumetric Analysis*" (Longmanns, London, 1918), and in Kingscott and Knight's "*Quantitative Organic Analysis*," p. 167.

Azo-dyestuffs.—Knecht, *J. Soc. Dyers and Col.*, 1903, VIII, 19; see also Knecht and Hibbert and Kingscott and Knight. (*Op. cit.*)

Indigo.—The estimation of indigo is treated fully by Green, "*Analysis of Dyestuffs*," Chap. VIII.; also by Kingscott and Knight, (*op. cit.* pp. 171–176). Individual methods for the estimation of indigo are to be found as follows: Potassium ferricyanide process, Ullgreen, 1865, 223.; Hyposulphite method, A. Müller, "*American Chemist*," *J. Chem. Soc.*, 5, 128; Sublimation method, C. Tennant, *Chem. News*, 1884.; Reduction by ferrous sulphate and sodium hydrox-

ide, Crace-Calvert, "Dyeing and Calico Printing," p. 196; Reduction by Sodium hyposulphite and Lime, C. Rawson (*J. Soc. Dyers and Col.*, **4**, 1).

Other literature on the subject includes: Ullgreen, "*Dingl. poly. J.*" **179**, 457; and *Wagner's J.*, 1865, 650; Leuchs, *J. prakt. Chem.*, **105**, 107: Mohr, *Dingl. poly. J.*, **132**, 363: W. P. Bloxam, *J. Soc. Chem. Ind.*, 1906, **25**, 735.

The form in which the dyestuff is presented for examination determines to some extent the method or methods which shall be adopted. Generally, however, it matters little if the substance itself or a dyed pattern is available, since the characteristic reactions in both cases are the same. But with the dyed material, owing to the extremely small amount of dyestuff available, the investigation is more difficult and the methods employed must be correspondingly more accurate.

Before proceeding to the analysis of a dyestuff it has first to be accertained whether or not it is homogeneous. A decigram or so of the product is blown against moistened filter paper; the different coloured spots which are formed reveal almost immediately the presence of a mixture. In certain cases capillary analysis, as described by Friedrich Goppelsroeder (Basel, 1901), can be used with success. A solution of a mixed dyestuff will invariably rise unevenly in filter paper, revealing thus the different components. This method is seldom used by the colour chemist.

I. SPECTROSCOPIC INVESTIGATION

The quickest and most reliable of all the existing methods for the investigation of a dyestuff is Formánek's spectrum determination. In the preceding part[1] all the spectra of commercial dyestuffs known up to 1926 have been given. The great advantage of the method lies in the fact that mere traces of the substance (fractions of a milligram) are, as a rule, sufficient for determining the spectrum with great accuracy. Triphenylmethane derivatives, Thiazines, Azines, Oxazines, Rhodamines, etc., are readily identified by their characteristic bands, and even a beginner is able to determine the spectrum in a few minutes, provided that he has at his disposal a first-class modern spectroscope. Excellent instruments for the

[1] This volume, pp. 19 *et seq.*

purpose are made by Hilger in London, Zeiss in Jena, and Keuffel and Esser in New York.

If a given dyestuff does not show a characteristic absorption spectrum, then so-called colour reactions with solutions of acids, bases and solvents have to be tried. The spectroscopic method is equally applicable to dyestuffs in substance and on the fibre. In the latter case the colouring matter has to be extracted from the fibre with a convenient solvent, such as water, acetic acid, methyl alcohol, ethyl alcohol or amyl alcohol, pyridine, xylene, etc. The method is in many cases astonishingly simple and absolutely reliable; great care has to be taken to use clear solutions. Further, it must be pointed out that, whereas the solvent has a marked influence on the position of the absorption maxima, it does not change the character and relative position of the bands.

Formánek has given twelve different types of bands; these may be consulted in his work.[1] They are also reproduced by Fierz-David "*Künstliche organische Farbstoffe*," Ristenpart and others. The tables and text of Formánek alone cover seven hundred pages.

Oxyanthraquinones, oxyazo-dyestuffs, Naphthazarine and other oxyketonic dyestuffs, as for example Cochineal, give with concentrated sulphuric acid and boric acid, most beautiful colorations which show characteristic absorption spectra.[2]

Finally it should be pointed out that the fluorescence which can be observed is very often characteristic. Thiazines, Azines, Rhodamines, Oxazine and Quinoline dyestuffs (sensitisers) are always fluorescent. In the case of the Azines, especially the benzene azines (Safranine), the fluorescence is often very weak. With the naphthoazines, on the other hand, as for example Wool fast Blue, Indocyanine or Magdala Red, the fluorescence is very marked. In doubtful cases a spectroscope which permits of simultaneous comparison of two spectra is very useful.

II. THE QUALITATIVE INVESTIGATION OF DYESTUFFS IN SUBSTANCE

The colour reactions of dyestuffs are given in the preceding part (pp. 19 *et seq.*).

(a) **General Outlines.**—Nitro- and Azo-compounds are reduced by strong reducing agents, such as tin chloride, zinc dust with ammonia

[1] Formanek, *Untersuchung und Nachweis org. Farbst.*, p. 8.
[2] See Formánek, and also Fierz, *Künst. org. Farbstoffe*, p. 498.

or sodium hydrosulphite, completely on boiling. The original colour does not reappear, but often a new colour is produced by the oxidation of these reduction products. These colour reactions are often very useful for the determination of the original components of the dyestuff. New amino-compounds are formed which give in very many cases definite and sharp reactions with ferric chloride solution (1:100), 1% ammonia, 1% sodium hydroxide or 1% hydrogen peroxide. A summary of the so-called splitting products of azo-dyes will be found in Fierz,[1] and Green[2] (incomplete).

(b) Other dyestuffs, as for example Stilbene, Thiazol (not all), Azines, Oxazines, Thiazines, Acridines, Quinolines, Vat-dyes, and also Sulphur-dyes are reduced by the reagents already given ($SnCl_2$, etc.), and the colour is often restored by adding hydrogen peroxide or simply by shaking the solution with air. Triphenylmethane derivatives, Malachite green, Fuchsin and so on, are also reduced, but the re-oxidation takes place much more slowly.

(c) **Vat-dyestuffs** are, as a rule, insoluble in water, but easily soluble in weakly alkaline hydrosulphite, and are re-oxidised by exposure of the solution to air. Ninety per cent of the vat dyes are well-defined chemical individuals. They may be recrystallised in many cases from glacial acetic acid or pyridine, and an accurate chemical analysis reveals the exact chemical composition. Where the vat dyestuff is insoluble in any solvent and cannot be recrystallised, it is nevertheless possible to purify it by producing the leuco base, filtering, and oxidising the leuco compound by exposure to air. By suitable extraction of the precipitate with water, alcohol, carbon disulphide, etc., it is possible to obtain the substance analytically pure.

(d) **Sulphur Dyes.**—Sulphur dyes are amongst the substances which, from the practical point of view, cannot be analysed. They may be characterised, however, by the evolution of hydrogen sulphide when heated with dilute hydrochloric acid, and by their ability to dissolve in aqueous sodium sulphide solution on warming. As the chemical constitution of the sulphur dyes is unknown, we must content ourselves with finding out whether or not a given dyestuff belongs to this class. If this has been determined, the preceding tables will in many cases show in which class the dye has to be placed.

[1] Fierz, *Künst. org. Farbstoffe*, pp. 660–666.
[2] Green, *Analysis of Dyestuffs*, Chapter IX.

III. THE QUALITATIVE INVESTIGATION OF DYESTUFFS ON ANIMAL FIBRE

Preliminary Investigation.—Valuable information as to the nature of a dyestuff may often be obtained by the application of a few simple preliminary tests which are equally applicable to all classes of dyed fibre. In this way whole classes of dyestuffs can be excluded and a valuable saving of time effected.

The complete removal of all sizing and dressing materials is first advisable, by boiling the dyed fibre with the requisite quantity of distilled water. Should a considerable amount of the dyestuff pass into solution during this operation, it may conveniently be investigated by direct methods.

Mordant dyestuffs are indicated if ash results when a small sample of the dyed fibre is incinerated in an ignition tube; in such cases the process should be repeated with larger amounts in a crucible, the ash being retained for examination of the metallic oxide. The colour of the oxide is a rough guide: Grey-green indicates *Chromium;* red-brown, *iron;* whilst a white residue may suggest either *aluminium* or *tin*. More accurate treatment is, however, advisable as follows: A yellow coloration obtained by heating a portion of the ash with potassium chlorate indicates *Chromium*. A further portion of the ash should be boiled with acetic acid and the filtrate examined for Cr and Al; the residue, after boiling with HCl, is tested for *Fe*, *Cu* and *Sn*. Copper is in some instances rather difficult to trace and may best be detected by the characteristic green flame obtained after moistening the ash with HCl.

Care must be exercised in the interpretation of these results, since tin salts are often used to "weight" silk during dyeing, whilst chromium is frequently used in the earlier stages of the production of artificial wool ("Kunstwolle" Shoddy, Laine renaissance). On the other hand, however, total absence of metallic oxides excludes the possible presence of all mordanted dyestuffs.

Indigo dyestuffs can often be detected during this preliminary examination. The "nitric acid spot" test, which depends on the production of a yellow spot with a green edge when the dyed cloth is touched with a drop of concentrated nitric acid, is not reliable, since it is given by many indigo substitutes. A much safer test is to boil the dyed pattern for several minutes with a small quantity

of freshly distilled aniline, and after complete evaporation of the solvent to heat the residue gently in the Bunsen flame; the emission of coloured vapours indicates an indigo dyestuff. A more detailed treatment of the individual members of this class will be given later.

Triphenylmethane dyestuffs are indicated when the dyed pattern, on treatment with concentrated sulphuric acid, becomes yellow or yellowish brown.

These preliminary investigations having to some extent narrowed the existing possibilities, further more general reactions are carried out to determine the chemical nature and dyeing properties of the substance. The application of these tests will be sufficient to allocate a dyestuff to its particular chemical group; final differentiation between individual members of a family can best be effected by comparison with standard dyed patterns.

Reagents.—Suitable reagents for a systematic dyestuff analysis are given by Green,[1] and should be prepared accurately to the given strength.

Dilute Ammonia (1:100).—1 c.c. of concentrated ammonia in 100 c.c. of distilled water.

Dilute Acetic Acid (5%).—5 c.c. of glacial acetic acid to 95 c.c. of water.

Aqueous Alcoholic Ammonia.—1 c.c. of concentrated ammonia to 50 c.c. of methylated spirit and 50 c.c. of water.

Dilute Alcohol.—(1:1). 50 c.c. of methylated spirit and 50 c.c. of water.

Dilute Hydrochloric Acid.—(1:10). 10 c.c. of concentrated hydrochloric acid to 100 c.c. of water.

Caustic Soda.—(10%) 10 grm. of sodium hydroxide in 90 c.c. of water.

Saline Caustic Soda.—10 c.c. of concentrated sodium hydroxide (35-40%) solution and 100 c.c. saturated sodium chloride solution.

Soap Solution.—10 grm. of soap in 300 c.c. of distilled water.

Hydrosulphite B.—50 grm. of Hydrosulphite NF concentrated (Meister), Hydralite C extra (Casella), or Rongalite C (Badische), dissolved in 500 c.c. of water and acidified with 2 c.c. of acetic acid. This is used only in the case of yellow and orange colours.

Hydrosulphite AX.—50 grm. of Hydrosulphite NF or Rongalite C are dissolved in 150 c.c., and to the solution 0.25 grm. of precipitated

[1] Green, *J. Soc. Dyers and Colourists*, 1905, 236.

anthraquinone is added at 80°–90°, after having previously been ground to a paste with a little of the solution, and the whole is diluted with 500 c.c. of cold water. The solution, which tends to become acid on keeping, should be kept alkaline.

Persulphate.—Cold saturated solution of the potassium salt, or 1% solution of ammonium persulphate.

Sodium Acetate.—5% solution.

General Procedure.—The stripping tests are conveniently carried out in test tubes with pieces of material 15 mm. square, about 5 c.c. of the reagent being used in each instance. The degree of stripping is judged by comparing the depth of the shade remaining with that of the original pattern; the colour of the stripping solution is generally a misleading factor. In cases where the fibre is composed of several threads differently coloured, these should be removed and tested separately.

It is generally found that boiling with dilute acetic acid or dilute ammonia can with advantage be twice repeated, whereby a more complete stripping is obtained. In dealing with the less easily extracted dyestuffs, such as many violets and blacks, alcoholic ammonia is found more effective.

Reduction tests require careful manipulation. The sample is boiled with the hydrosulphite for one minute, thoroughly washed under the tap, and then allowed to lie on white paper for an hour. With most air-oxidisable leuco compounds a few minutes are sufficient for the return of the colour, but this may be accelerated by exposure to ammonia vapour or by boiling the sample with water to which potassium persulphate is gradually added. The depth of the restored colour does not in all instances equal that of the original, whilst in other instances, notably in the case of Safranine and its azo derivatives, a violet colour is produced as a result of condensation between the leuco-safranine and the formaldehyde in the Hydrosulphite NF.

While the reactions here described refer primarily to wool dyed patterns, they can, with slight modifications, be applied to other classes of vegetable fibre.

Treatment of Mixtures.—All processes for the investigation of dyestuff mixtures are similar in principle, in that they all entail some preliminary separation of the constituents. If these belong to one chemical group the matter is somewhat easier, since they will

behave as a chemical entity. The identification of individual members can often be accomplished by careful fractional reduction with Hydrosulphite which attacks different dyestuffs at varying speeds. For example, "Marine Blue," produced by mixing Patent Blue with Orange II, on reduction with hydrosulphite quickly loses the orange colour, while the blue persists for some time; on subsequent oxidation the blue alone reappears.

Processes of fractional extraction of the dyestuff are very largely employed, the extracted colours being transferred to wool or silk and tested separately. In this way, by Soxhlet extraction with dilute alcohol or pyridine, mordant dyestuffs may be separated from a mixture; the other constituents pass into solution leaving the mordanted dyestuff on the fibre. In the separation of Indigo from other "vat" dyestuffs, use is made of the peculiar solubility of the former in cresol (most suitable mixture being 30 parts of "Solvent Naphtha" or of petroleum spirit, b.p. 120°–140°C., with 100 parts of cresol). The extraction is carried out in a Soxhlet apparatus at 100°–105°C. Another reagent especially suitable for fractional extraction is amyl alcohol.

In all instances, after extraction, the dyestuff may be recovered by evaporation of the solvent, or the solution may be subjected directly to spectroscopic examination.

III. A NOTE ON GREEN'S TABLES

Green, in his classic work, has given thirty large tables which are, combined with the spectroscopic method, the only means for the exact analysis of dyestuffs. These tables have been published in so many books that it has been considered unnecessary to reprint them here.

IV. THE QUALITATIVE INVESTIGATION OF DYESTUFFS ON VEGETABLE FIBRE

Initial difficulties, arising out of differences in the nature of the fibre, render it impossible to apply to vegetable fibres a scheme of investigation identical with that already described for the treatment of dyestuffs on wool or silk. An outstanding fact in this connection is that many basic dyestuffs which are readily stripped from wool by the action of hydrosulphite are unattacked when attached to tannin-mordanted cotton. In such cases it is first necessary to

remove the tannin by boiling the pattern with caustic soda which is saturated with common salt, to avoid simultaneous stripping of the dyestuff. The basic colouring matter thus purified can generally be stripped by boiling with dilute acetic or formic acid.

Again, it has been found that, whereas in the case of wool dyed patterns the leuco bases remain on the fibre and are oxidisable, these leuco compounds are either unobtainable or pass directly into solution when the dyestuff is on tannin-mordanted cotton. This difficulty is avoided by transferring the dyestuff to wool, when the reactions may be carried out in the usual way. This step also renders it possible to increase greatly the concentration of the dyestuff on the fibre. Such a transference is especially efficacious in the case of acid and basic dyestuffs, but in all other instances the oxidations and reductions must be carried out on the fibre itself.

Difficulty is sometimes experienced in differentiating the "salt" dyestuffs, and this is greatly accentuated by the relatively large choice which this class of dyestuff affords. In such instances the dyed pattern is boiled with white cotton in soap or sodium carbonate solution; the degree of staining is generally less with the developed colours than with the fixed dyestuffs.

Preliminary Investigations.—Before carrying out the tests as described in Green's Tables, it often useful to make a few preliminary tests which may exclude whole classes of dyestuffs.

Transference of Basic Colours to Wool.—For the reasons already stated it is often preferable to carry out the tests on animal rather than on vegetable fibre, and a transference is therefore necessary. The mordant having been removed as already described, the pattern is washed entirely free from alkali and boiled with a piece of wool in plain water for several minutes, which suffices in most instances for a complete transference of the dye-base to the wool. In some cases it may be necessary to aid this process by the addition of dilute formic acid (1:100), or more rarely a subsequent extraction of the dyestuff with hydrochloric acid (1:20) may be advisable.

Transference of acid colours to wool is effected by boiling the specimen with wool in weak formic acid (1:100).

Salt and Acid Dyestuffs.—Owing to the fact that some "salt" dyestuffs suffer stripping when boiled with dilute ammonia, it is advisable to add a small piece of cotton when carrying out this test; a brown stain indicates a salt dyestuff.

Tests for Vat Dyestuffs.—Green[1] divides these into two classes, namely, the Anthracene and the Indigoid class. According to his directions (*loc. cit.*) these may be readily identified by boiling the pattern for 1 minute with Hydrosulphite X. Indigoid colouring matters are reduced to pale yellow or colourless leuco compounds, the original colour being restored on exposure to air either directly or in two stages in the case of several reds. Anthracene colours, on the other hand, give, as a rule, deeply coloured leuco compounds which are readily oxidised. The ordinary confirmatory tests can be applied as already given for indigo.

Tests for the Sulphide Colours.—These are readily detected when the pattern is boiled with acid stannous chloride solution and the vapour tested for hydrogen sulphide with lead acetate paper. In interpreting these results it is essential to guard against traces of sulphur which may be present on the cotton. It is therefore advisable first to boil the pattern for half a minute with 10% caustic soda, the tests being applied after complete removal of the alkali.

Titanous Chloride as a Reagent in Preliminary Tests.—The reducing properties of titanous chloride led Knecht to recommend its use in the investigation of colouring matter on the fibre.[2] Its action on the most important groups of dyestuffs may be briefly indicated as follows:

Basic Colours.—These colours are in most cases completely reduced, the colour being destroyed and the fibre becoming brown, owing to the deposition of the metallic tannate. As the reduction invariably proceeds beyond the formation of the leuco base, the colour is not restored by subsequent oxidation.

Azo-dyes on cotton, are almost immediately decolorised when boiled with dilute solutions of the reagent; the actual time required varies with the dyestuffs. Members of the primulene class (undeveloped) are very slowly affected by the reagent.

The Sulphur Dyestuffs.—On treatment with titanous chloride the sulphide colours lose their characteristic shade, the change being accompanied by the evolution of hydrogen sulphide. The colour is more or less restored by boiling with hydrogen peroxide.

Vat Dyestuffs, Indigo.—Careful treatment with the reagent results in the production of the white leuco base, which yields the original

[1] Green and Frank, *J. Soc. Dyers and Colourists*, 1910, 83.
[2] Knecht, *J. Soc. Dyers and Colourists*, 1904, **20**, No. 4.

indigo colour on oxidation. Where the reduction goes beyond this indigo white stage it cannot be reproduced by oxidation. The reagent is especially useful in the investigation of indigoid colours which have been "bottomed" by the use of sulphide dyestuffs (extraction see page 622, 626).

In addition to the foregoing classes, many well known individual dyestuffs behave in a characteristic manner when treated with this reagent. Thus *Aniline blacks* are turned drab brown, hydrogen sulphide being evolved (from CuS), although naturally not in such quantity as in the case of the sulphide colours.

Other Reagents.—In addition to the reagents already recommended for the treatment of dyestuffs on wool, the following will be found of use:

Tannin Solution.—10 grm. of tannin and 10 grm. of sodium acetate in 100 c.c. of water.

Bleaching Powder Solution.—Freshly prepared at 5°Tw.

Hydrosulphite BX.—Since it has been found that many azo-compounds are only reduced with great difficulty by hydrosulphite solution, use is made of the fact that this reducing power is greatly increased by the presence of certain colouring matters or other reducible substances. Of these, the most important are Induline Scarlet, Alizarine, and Anthraquinone, the last being most generally used. The solution is prepared as follows: 50 grm. of Rongalite or Hydrosulphite NF are dissolved in 125 c.c. of water, and a portion of this solution is used to make a paste with 1 grm. of finely ground precipitated anthraquinone. The remaining solution is then added, and the whole heated at 90° for two minutes, after which it is diluted with 500 c.c. of water, and, when cold, with 112 c.c. of glacial acetic acid. The reagent should be kept in well stoppered bottles.

Persulphate Solution.

Acid Stannous Chloride.—100 grm. stannous chloride to 100 c.c. of analytically pure hydrochloric acid (30 %).

Chromium Fluoride Reagent.—10 grm. of chromium fluoride and 5 grm. of sodium acetate in 100 c.c. of water.

General Procedure.—It is generally convenient in dealing with calico prints to cut out the different shades and to apply the tests to each separately. Differentiation between individual members of the same group is facilitated by observing their behaviour with

concentrated sulphuric acid or sodium hydroxide.[1] Should the application of the foregoing preliminary tests have failed to elucidate the constitution of the dyestuff, systematic tests should be carried out in accordance with the schemes outlined in preceding sections.

V. CHEMICAL REACTIONS OF THE MORE IMPORTANT CLASSES OF DYESTUFFS

The following outstanding reactions of the more important dyestuffs may conveniently serve either to supplement or as a substitute for the schemes of analysis already outlined.

General. *Oxidation and Reduction Methods.*—The table due to Green epitomises clearly the behaviour of the more important colouring-matters on animal fibres when subjected to oxidation or reduction.

Where it is possible, by processes of extraction, to isolate quantities of the dyestuff from the fibre in amounts up to one grm., this material may be conveniently distilled with zinc dust according to the method of Baeyer;[2] this method is especially useful in cases where a more accurate knowledge of the constitution of a particular dyestuff is required. In such cases reduction with hydriodic acid, due to Berthelot,[3] is almost equally effective.

Individual. *Anthracene Dyestuffs.*—The presence of alizarine may often be detected by the characteristic colour of its alkali salt produced by treating the fibre with concentrated sulphuric acid, and pouring the dilute extract into caustic soda solution. The various lakes can be identified by their colours after precipitation.[4]

Indigo.—The indigo dyestuff may generally be extracted by boiling the fibre for some time with glacial acetic acid, aniline or chloroform, the dyestuff being isolated pure on evaporation of the solvent. The presence of impurities in an indigo colouring matter can be detected by adding water to the ethereal extract; the indigo remains in the ether, while any impurities will serve to colour the aqueous layer.

Pure indigo is not extracted by boiling borax or alum solutions. On the other hand, if the dyed fabric has been after-treated with logwood the borax solution will be red, if with aniline colours or with

[1] Green, Yeoman and Jones, *J. Soc. Dyers and Colourists*, 1905. 235.
[2] Baeyer, A., 140, 205, also Meyer, "*Analyse org. Verbindungen*," p. 523, and Gattermann, "*Die Praxis des org. Chem.*" 15 edition, p. 345.
[3] Meyer, "*Analyse org. Verbindungen*," p. 529.
[4] The colour of a lake is, as a rule, determined by boiling the solution of the mordant dye with the so-called "Scheurer Strap" (Scheurer Streifen). This consists of a piece of calico on which are printed in narrow stripes the acetates of Al, Fe, Cr, Ni, Co, Ti, Sn, Sb and Cu. The dye is developed very often in such a characteristic manner that the substance is at once identified.

indigo carmine it will be blue. Further, if this blue solution is treated with concentrated sulphuric acid it will be changed to yellow or red if aniline colours are present, but will remain unaltered if only indigo carmine has been added.

The presence of Prussian blue in an indigo dye is indicated by the production of a brown colour when the fibre is treated with sodium carbonate solution.

Aniline Black.—This undergoes characteristic colour changes when treated with certain reagents. Thus with bleaching powder it becomes brown, is changed to green or black by the action of sulphurous acid, and is completely decolorised by the action of a concentrated solution of potassium permanganate, and by oxalic acid after prolonged action.

Magenta is completely decolorised by the action of sodium sulphide solution. A similar effect is obtained by treating it with ammonia; under the same conditions Archil becomes blue, whilst Aurine remains unchanged.

Methylene blue becomes green when treated with nitric acid; with bleaching powder the colour becomes first green and finally disappears. The colour is very sensitive on the fibre, being readily discharged by a 3 % solution of potassium dichromate.

The Eosines.—Eosine A treated with boiling KOH (20–40%) becomes orange red, then purple, and finally blue with a green fluorescence. The ethyl salt (Eosine B) under the same conditions gives a blue-violet solution, whilst Eosine BN gives an olive green solution which does not exhibit fluorescence. For further reactions of the older dyestuffs reference should be made to Cain and Thorpe, "*Synthetic Dyestuffs*," p. 386.

VI. QUANTITATIVE ANALYSIS OF DYESTUFFS

For the investigation of dyestuffs in substance or on the fibre many methods are available, the choice naturally depending on the nature of the given colouring matter. Unless the class of dyestuff is already known, it must be determined by a rough preliminary qualitative examination. In the present work only the more representative analytical methods will be described, and for further particulars the reader is referred to specific literature dealing with this subject.[1]

[1] See the summary of literature, p. 613–616.

The actual methods are divided into two classes. Firstly, the relative methods in which a standard specimen of a particular dyestuff, itself not necessarily 100% pure, is used as a standard of comparison. Secondly there are the absolute methods, whereby characteristic chemical groups are estimated quantitatively.

A. Relative Methods. I. *Estimation by Means of Comparative Dyeing.*—While this method is useful primarily for the investigation of dyestuffs in substance, it can also be adapted to the examination of dyestuffs on the fibre, and it is sufficiently accurate and simple to find general favour as a works' method. A definite quantity of the given dyestuff (about 0.2 grm.) is dyed on to 10 grm. of wool or cotton under specified conditions, and the resulting pattern, when dry, is compared with a series of dyed patterns. The personal factor enters largely into this method, and its accuracy depends on the quality of the observer's eyes and his power of judgment. It is often very difficult, as for example with certain yellows, to detect minute differences in shade. This is generally eradicated by dyeing the test piece, and the corresponding "standard," blue; differences in the resulting green are readily detected. The method has later been improved by Auerbach,[1] who uses a colour filter when comparing the test piece with the standard pattern.

II. *Colorimetric Estimation.*—The dyestuff is here estimated by comparison of the strength of the colour of its solution with that of a given standard solution, observations being made by means of a colorimeter. When dyed patterns are submitted, it is necessary first to extract the colouring matter from the fibre, and to redissolve it in a suitable solvent for examination.

B. Absolute Methods. I. *Titration with Titanous Chloride.*—The reduction methods with titanous chloride, due to Knecht and Hibbert,[1] are especially suitable for the estimation of Azo-, Nitro- and Quinone groups. The titanous chloride is oxidised to the tetrachloride, with the liberation of one atom of hydrogen; for complete reduction, therefore, quinone groups require two, azo groups four, and nitro groups six molecules of $TiCl_3$. For detailed description of the methods the reader is referred to the work quoted; a brief outline is as follows:

Preparation of Titanous Chloride Solution.—This may be prepared either from the violet aqueous 15% solution of $TiCl_3$ (Merck), or

[1] Knecht and Hibbert, "*New Reduction Methods in Volumetric Analysis.*" (Longmans, London, 1918.)

from the colourless anhydrous $TiCl_4$. The former is probably the more simple, the $TiCl_3$ being first boiled with concentrated hydrochloric acid and then diluted with air-free distilled water to about $\frac{1}{10}$ normal. When $TiCl_4$ is used it is reduced to the violet trichloride by boiling with excess of tin in concentrated hydrochloric acid solution, the tin being completely removed by passing hydrogen sulphide through the solution. This is in turn removed from the solution by a stream of carbon dioxide.

The titanous chloride solution is readily standardised by titration with N/10 ferrous sulphate solution (48.219 grm. of crystallised ferrous ammonium sulphate with 40 cc. of concentrated sulphuric acid made up to one litre) at room temperature in carbon dioxide, the special apparatus being used.

Titration of Azo-dyestuffs.—To a known quantity of the given azo solution several c.c. of concentrated hydrochloric or sulphuric acid are added, the special apparatus necessary being used. The solution is boiled, and the $TiCl_3$ solution is added until the colour disappears, the dyestuff thus serving as indicator. This "direct" method of titration is only possible with the more easily reducible substances. In cases where the reduction is slower, or where the dyestuff is precipitated by acid, excess of the titanous chloride solution is added and the excess "back titrated."

Titration of Quinone Dyestuffs.—The method is readily applicable to the ortho compounds of the Methylene Blue type, but, although the para derivatives of the Triphenylmethane type should from theory conform to titration, the results obtained are not always successful. For dyestuffs of this class Calcott and English[1] recommend the following treatment. "The dyestuff is dissolved in 100 c.c. of 50% alcohol, to which is added 50 c.c. of a 25% solution of sodium tartrate or Rochelle salt (sodium potassium tartrate). This is boiled for 3–5 minutes and titrated warm." Under these conditions Crystal Violet and Acid Green give good results, although Malachite Green is generally too high; this is in direct contradiction to the results of Salvaterra.[2]

For further details of these methods the reader is referred to specific literature which is conveniently epitomised in *Helv. Chim. Acta*, 1924, 7, 510.

[1] *Ind. Eng. Chem.*, October, 1923.
[2] *Monatshefte*, 1923, 34, 258.

II. Titration with Hydrosulphite.—The use of sodium hydrosulphite ("Hydros") for the reduction of vat dyestuffs to the corresponding leuco base is well known; the method may also be extended to the quantitative estimation of these dyestuffs. Details of certain refinements and modifications are given in the communications of Grandmougin and Havas (*Chem. Ztg.*, 1912, **36**, 1167), and also of Siegmund (*Monatshefte*, 1912, **33**, 1432). The methods of standardisation of the hydrosulphite solution and the general procedure in titrating the dyestuff are similar to that already described in the case of titrations with titanous chloride.

Azo-dyestuffs are best titrated at 70–80° C. in the following manner: 50 c.c. of an approximately 0.2% solution of the dyestuff is treated with 10 c.c. of 20% tartaric acid and the solution boiled for several minutes until free of air. It is then cooled to 70–80 C. in a stream of carbon dioxide and titrated at this temperature. The reduction takes place according to the following equation:

$$R.N = N.R_1 + 2Na_2S_2O_4 = RNH_2 + R_1NH_2 + 4NaHSO_3.$$

Triphenylmethane colouring matters, on the other hand, are treated somewhat differently. 50 c.c. of a 0.2% solution are titrated in the presence of 25 c.c. of 20% Rochelle salt solution and 1 c.c. of dilute hydrochloric acid. The results generally obtained with this class of dyestuff are somewhat indifferent.

Indigo is most suitable titrated by using hydrosulphite specially prepared by the Badische Anilin and Sodafabrik; an exceedingly useful guide, giving full working details for the analysis of this dyestuff is published by the same firm.[1] The introducton of the numerous synthetic indigo colouring matters has rendered this method of less general importance.

The Estimation of Indigo.—When dyed patterns are submitted the dyestuff is conveniently extracted in a Soxhlet extractor. With acetic acid as solvent the extraction is unduly prolonged; pyridine is found to be much more effective. For quantitative estimation 3–15 grm. of the cloth, sufficient to give 0.03–0.10 grm. of the dyestuff, are extracted with pyridine, the process being continued until the extract no longer has a blue colour; the time required varies from one and a half to four hours according to the nature of the materials. The extract is distilled down to 20–30 c.c., the pyridine

[1] *Indigo rein, B.A.S.F.*

being recovered. The solution is then allowed to cool, when the greater portion of the indigo will separate out as well-defined bronze crystals. The precipitation is completed by the addition of 100 c.c. of 50% alcohol, the solution filtered through an ordinary Gooch crucible, and the precipitate washed with dilute alcohol followed by hot 2% caustic soda solution, dilute hydrochloric acid (1%), hot water, alcohol, and finally alcohol and ether. The crucible is then dried at 110° and weighed.

After extraction the indigo may be estimated by titration. This is accomplished by first rendering it soluble by sulphonation with 15–20 c.c. of concentrated sulphuric acid in an oven at 70–80° for 45 minutes. The solution is made up to 500 c.c. and titrated with N/50 permanganate, 100 c.c. diluted with 200 c.c. of water being used for each titration (1 c.c. N/50 permanganate is equivalent to 0.00147 grm. of indigo).

BIBLIOGRAPHY

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